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# Radiation Dose Calculations for Geologic Media Around Spent Fuel Emplacement Holes in the Climax Granite, Nevada Test Site

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May 27, 1981



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# **Radiation Dose Calculations for Geologic Media Around Spent Fuel Emplacement Holes in the Climax Granite, Nevada Test Site**

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# Radiation Dose Calculations for Geologic Media Around Spent Fuel Emplacement Holes in the Climax Granite, Nevada Test Site

## ABSTRACT

Lawrence Livermore National Laboratory has emplaced 11 spent nuclear-reactor fuel assemblies in the Climax granite at Nevada Test Site as part of the National Waste Terminal Storage Program. One of the objectives is to study radiation effects on the rock. The neutron and gamma ray doses to the rock are being determined by calculation and measurement. This report discusses calculations performed using the MORSE-L Monte Carlo code to determine dose rates and doses in the materials surrounding the spent fuel assemblies. The initial maximum dose rate to the granite is about 25 mGy/s ( $9 \times 10^3$  rad per hour), and the maximum dose integrated over five years is about 2.2 MGy (220 Mrad). The dose rate is nearly constant over the central 2.44 m of the spent fuel assembly, and drops off approximately exponentially with radius in the granite.

## INTRODUCTION

As part of the National Waste Terminal Storage Program, Lawrence Livermore National Laboratory has emplaced 11 canisters of spent nuclear fuel from a commercial power reactor into holes drilled in a granite formation. This project, called the Spent Fuel Test-Climax, is being carried out at the Nevada Test Site.<sup>1</sup> Plans call for the spent fuel to be left in place for three to five years while measurements of temperatures, stresses, and displacements are made, and then to be removed to allow inspection of the holes and post-testing of the granite. One of the objectives of the project is to determine what effects the radiation from the spent fuel will have on the rock and backfill materials. Also of interest are radiation effects on the temperature profiles, corrosion of the steel liners, and radiolysis of water which may be present.

A plan has been written to study these radiation effects.<sup>2</sup> The plan calls for measurements of thermoluminescence and changes in the rock's thermal, mechanical and structural properties. Con-

sideration is also being given to changes in ion-exchange properties.

In order to understand the results of these measurements, as well as to relate them to other work, it is necessary to evaluate the radiation dose in the materials around the emplacement holes. This is being accomplished by a combination of *in situ* measurements and calculations. The measurements are being carried out under a contract with E G & G Inc., of Goleta, Ca.<sup>3</sup> They include gamma ray dosimetry by optical absorption measurements in<sup>7</sup> LiF and neutron dosimetry by activation and subsequent gamma ray counting of cobalt metal foils. This report discusses the calculational part of the dose evaluation, which consists mainly of Monte Carlo radiation transport calculations. By combining these two efforts, we can check the results against each other, and we can obtain a detailed picture of the variation of dose with position, in the region of interest.

## CHARACTERISTICS OF RADIATION SOURCE

The spent fuel used in the Spent Fuel Test-Climax was manufactured by Westinghouse Electric Corporation and burned in Turkey Point Unit 3, which is a pressurized-water reactor owned and operated by Florida Power and Light Company. The fuel was discharged from the reactor on November 19, 1977. Three of the spent fuel assemblies (D01, D04, and D06) were given a detailed pre-test examination before emplacement. This examination was conducted at the Battelle Columbus Laboratories under the direction of the Hanford Engineering Development Laboratory (HEDL).<sup>4</sup> Calorimetric measurements of decay heat were also performed by HEDL on four assemblies, and the results were in good agreement with calculations.<sup>5</sup> Eleven of the spent fuel assemblies were emplaced in the Climax stock granite at Nevada Test Site during April and May, 1980.

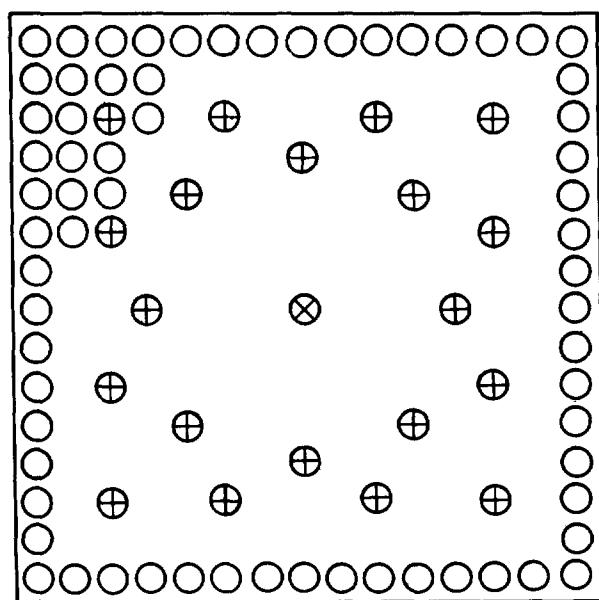
Each fuel assembly<sup>6</sup> consists of a bundle of Zircaloy-4 tubes in a 15 × 15 square array. The tubes contain spent UO<sub>2</sub> fuel pellets. Each assembly is about 4.09 m long overall, including the fuel tubes and the nozzles. The outside diameter of each fueled tube is 10.7 mm, and the wall thickness is 0.617 mm. The center-to-center spacing of the tubes is 14.3 mm. The overall outside dimensions of the section containing spent fuel are 0.214 m square by 3.66 m long.

In each assembly there are 20 control rod guide tubes and one instrument tube, distributed as shown in Fig. 1. These have an outside diameter of 13.8 mm and a wall thickness of 0.43 mm. (The guide tubes are actually smaller in diameter at the bottom to serve as dashpots, but this is not important for present purposes.) Originally, there were 204 fueled tubes in each assembly. However, HEDL and Battelle<sup>4</sup> removed four fueled tubes from each of three assemblies (D01, D04, and D06) and replaced them with stainless steel dummy rods. In addition, the central instrument tube in these three assemblies contains a package of material samples whose chemical compatibility under irradiation is being studied. Each assembly has seven spacer grids to support the tubes.

The spent fuel emits both gamma rays and neutrons. The source strengths have been determined by HEDL<sup>5</sup> using the ORIGEN2 code.<sup>7</sup> For the time period of interest, the gamma ray emission is dominated by four nuclides (or nuclide pairs):

<sup>106</sup>Ru-<sup>106</sup>Rh, <sup>134</sup>Cs, <sup>137</sup>Cs-<sup>137</sup>Ba, and <sup>144</sup>Ce-<sup>144</sup>Pr. The concentrations in gram-atoms calculated for assembly number D34, at 740 d since discharge, were supplied to us by Frank Schmittroth of HEDL,<sup>8</sup> and are shown in Table 1. The activities of these four emitters were then calculated for the ages of interest, using known half-lives.<sup>9</sup> The values for an age of 2.45 y since discharge are also shown in Table 1. This age corresponds to May 1, 1980, which is approximately the average date of emplacement for the fuel assemblies. The actual emplacement dates for each assembly are shown in Table 2. Activities for later times were calculated by simple decay.

The calculated neutron source strengths for assembly D34 were also supplied to us by Schmittroth.<sup>8</sup> Neutron emission is dominated by spontaneous fission of <sup>244</sup>Cm. There are also contributions from spontaneous fission of other actinides and (alpha, n) reactions on the oxygen of the UO<sub>2</sub>.<sup>10</sup> At 740 d since discharge, the total emission rate is  $1.24 \times 10^8$  neutrons/s. Although the decay is less straightforward because of the in-growth of



- ⊗ Instrument tube
- ⊕ Empty guide tube
- Tube containing UO<sub>2</sub>  
(only a few are shown)

FIG. 1. Cross section of Westinghouse 15 × 15 PWR fuel assembly.

TABLE 1. Significant gamma emitters in the spent fuel assemblies.

Nuclide	Concentration at 740 d (gram-atoms) <sup>8</sup>	Half-Life <sup>9</sup>	Activity at 2.45 y (Ci)
<sup>106</sup> Ru- <sup>106</sup> Rh	0.1575	366.5 d	$4.18 \times 10^4$
<sup>134</sup> Cs	0.1595	2.062 y	$2.40 \times 10^4$
<sup>137</sup> Cs- <sup>137</sup> Ba	3.202	30.17 y	$3.76 \times 10^4$
<sup>144</sup> Ce- <sup>144</sup> Pr	0.1516	284.5 d	$4.77 \times 10^4$

TABLE 2. Characteristics of emplaced spent fuel assemblies.

Assembly No.	Fuel Loading <sup>13</sup> (MTU) <sup>a</sup>	Burnup <sup>12</sup> (MWD/MTU) <sup>b</sup>	Gamma Source Strength (relative to D34)	Emplacement date (1980)
D01	0.456902	28430	1.031	May 15
D04	0.456655	28430	1.030	May 28
D06	0.454893	28430	1.026	May 13
D09	0.457078	27863	1.004	May 1
D16	0.457722	27863	1.005	May 20
D18	0.457360	27863	1.005	April 22
D34	0.455237	27863	1.000	April 25
D35	0.454673	28430	1.026	May 6
D40	0.456091	28430	1.029	April 18
D46	0.456224	28430	1.029	April 29
D47	0.456373	28430	1.030	May 8

<sup>a</sup>Metric tons of uranium.

<sup>b</sup>Megawatt days per metric ton of uranium.

<sup>241</sup>Am, the total neutron emission decreases with time over the period of interest.

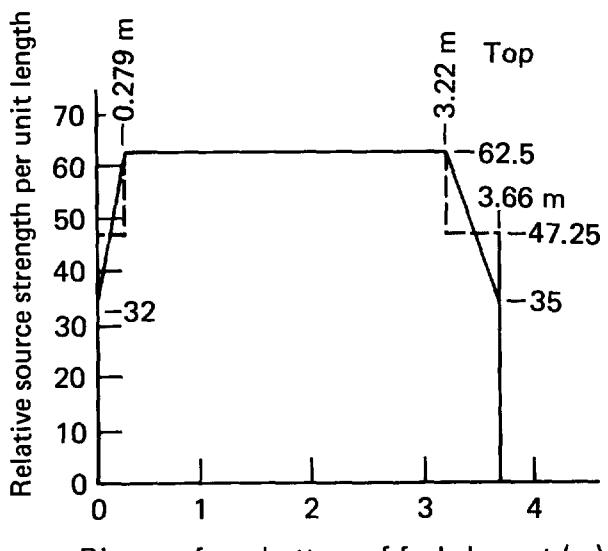
The axial distribution of source strength can be estimated from the <sup>137</sup>Cs gamma scans performed by HEDL and Battelle.<sup>4</sup> (The two cesium isotopes are the dominant gamma emitters during the time period of interest, and are also the most mobile, owing to higher volatility.) Several of the gamma scans presented in the HEDL report<sup>4</sup> were hand fitted with trapezoid-shaped curves and averaged. The averaged curve is shown in Fig. 2. As can be seen, the source strength is uniform over most of its length, decreasing at each end. The decrease starts further from the end at the top because of the presence of the control rods there during reactor operation.

In the absence of information to the contrary, and in the knowledge that the reactor core is large compared to the width of a fuel assembly, and that the control rods are well distributed, it was assumed that the source strength does not vary significantly across the lateral dimensions of the fuel assemblies.

The gamma ray yields for the significant gamma emitters are shown in Table 3.<sup>9</sup> Since most of the neutrons result from spontaneous fission, it was assumed that their spectrum is given by an equation of the form

$$N(E) = Ae^{-0.88E} \sinh \sqrt{2.0E},$$

where E is the energy (in MeV) and A is a constant.<sup>11</sup>



**FIG. 2. Axial gamma source distribution (dotted lines show the configuration used in the computer simulation).**

Although the radiation source strengths of the 11 emplaced spent fuel assemblies are nearly the same, there are small differences because of variations in fuel loading and burnup<sup>12,13</sup>(see Table 2). The removal of fuel tubes from near the centers of three of the assemblies, as mentioned above, should not have a significant effect on the external fields, since little of the radiation from the interior tubes reaches the surface of an assembly, owing to self-shielding. We have therefore ignored the fact that some fuel tubes were missing.

Schmittroth et al.<sup>5</sup> have calculated the heat output of the assemblies. Since most of the heat output during the time period of interest comes from nuclides which are also the significant emitters of gamma rays,<sup>10</sup> it appears that a satisfactory estimate of relative gamma ray source strengths can be obtained by use of relative heat output. We have therefore taken ratios of their results for heat output (correcting them for actual fuel loading<sup>13</sup>). The relative heat outputs of different assemblies vary slightly over time, because of different relative amounts of the radionuclides, but over the time span of interest, this variation amounts to only 0.2%, and we have therefore ignored it. The relative gamma ray source strengths determined in this way are shown in Table 2.

It is more difficult to estimate the relative neutron source strengths, but since the dose from neutrons to the granite turned out to be small compared to the dose from gamma rays, as pointed out below, we did not believe it necessary to estimate these neutron source strengths.

A more important consideration in comparing the actual doses to material around the 11 emplacement holes is the fact that they have different emplacement dates. However, this effect can be calculated only when the contributions of each of the radionuclides to the total dose is known; we discuss this in more detail later.

**TABLE 3. Gamma ray yields<sup>9</sup> of the significant gamma emitters in the spent fuel assemblies.**

Nuclide	Energy (MeV)	Gammas/disintegration
<sup>106</sup> Ru- <sup>106</sup> Rh	0.5118	0.19
	0.6163	0.0082
	0.6221	0.098
	0.8738	0.0045
	1.0507	0.016
	1.128	0.0042
	1.562	0.0017
<sup>134</sup> Cs	0.4753	0.01465
	0.5632	0.0838
	0.5693	0.1543
	0.6047	0.9756
	0.7958	0.8544
	0.8019	0.0873
	1.0386	0.0100
	1.1679	0.01805
	1.3651	0.0304
	1.4005	0.0008
<sup>137</sup> Cs- <sup>137</sup> Ba	0.6616	0.850
<sup>144</sup> Ce- <sup>144</sup> Pr	0.0801	0.0113
	0.1335	0.111
	0.6965	0.0133
	1.4891	0.0029
	2.1856	0.0075

## GEOMETRY OF EMPLACEMENT

Information about the emplacement geometry was obtained from Refs. 14 and 15. The geometry described in these publications is approximated by that shown in Fig. 3. Note that the non-fueled parts of the assembly at top and bottom have been left out, as have the spacer grids and assembly support cage. The top plug geometry has been simplified.

Each spent fuel assembly was inserted into a stainless steel canister 356 mm in outside diameter, with a wall thickness of 9.52 mm. The assembly was supported by a thin stainless steel cage welded to the inside of the canister. Each canister was backfilled with helium gas and welded shut.

The canisters were lowered into vertical holes drilled into the floor of a drift mined in the quartz monzonite unit of the Climax Stock, located at the Nevada Test Site. The holes were lined with carbon steel liners prior to insertion of the canisters. These liners were grouted in position at top and bottom. The liners have an outside diameter of 457 mm and a 6.35 mm wall thickness. The holes in the granite have a diameter of 610 mm. A large steel shield plug covers each canister. The grouting was limited to regions above and below the active section of the spent fuel.

The space between the canister and liner is filled with air. The region between the liner and the granite was initially filled with air. However, it was recognized that water may seep into this region through cracks in the granite. Also, it is possible to remove some of the spent fuel after three years and backfill this region with an ion exchange material such as bentonite clay. Accordingly, it is of interest to calculate doses for the four cases of air, water, compacted bentonite, and a sand-bentonite mixture in this region.

Small holes were drilled into the granite near the emplacement holes for insertion of instrumentation and dosimeters.

Figure 4 shows the geometry used for calculational purposes.

## DESCRIPTION OF MATERIALS

The parameters of importance for calculation of radiation transport are density and chemical composition. The values used are shown in Table 4. It was estimated that 3.0% of the uranium in the fuel had been converted to fission products, with an

average atomic number of 116.<sup>10</sup> The density of UO<sub>2</sub> was taken to be the "planar smear density" with the "dish smeared in."<sup>12</sup> That means that the density was calculated by dividing the mass of the UO<sub>2</sub> by the entire inside volume of the cladding tubes. (The "dish" refers to the concave surface machined into the ends of the fuel pellets to allow for expansion.) The grout composition was approximated from handbook information.<sup>20</sup> The bentonite backfill materials are those used in the Swedish KBS study.<sup>21,22</sup>

## CALCULATIONAL APPROACH

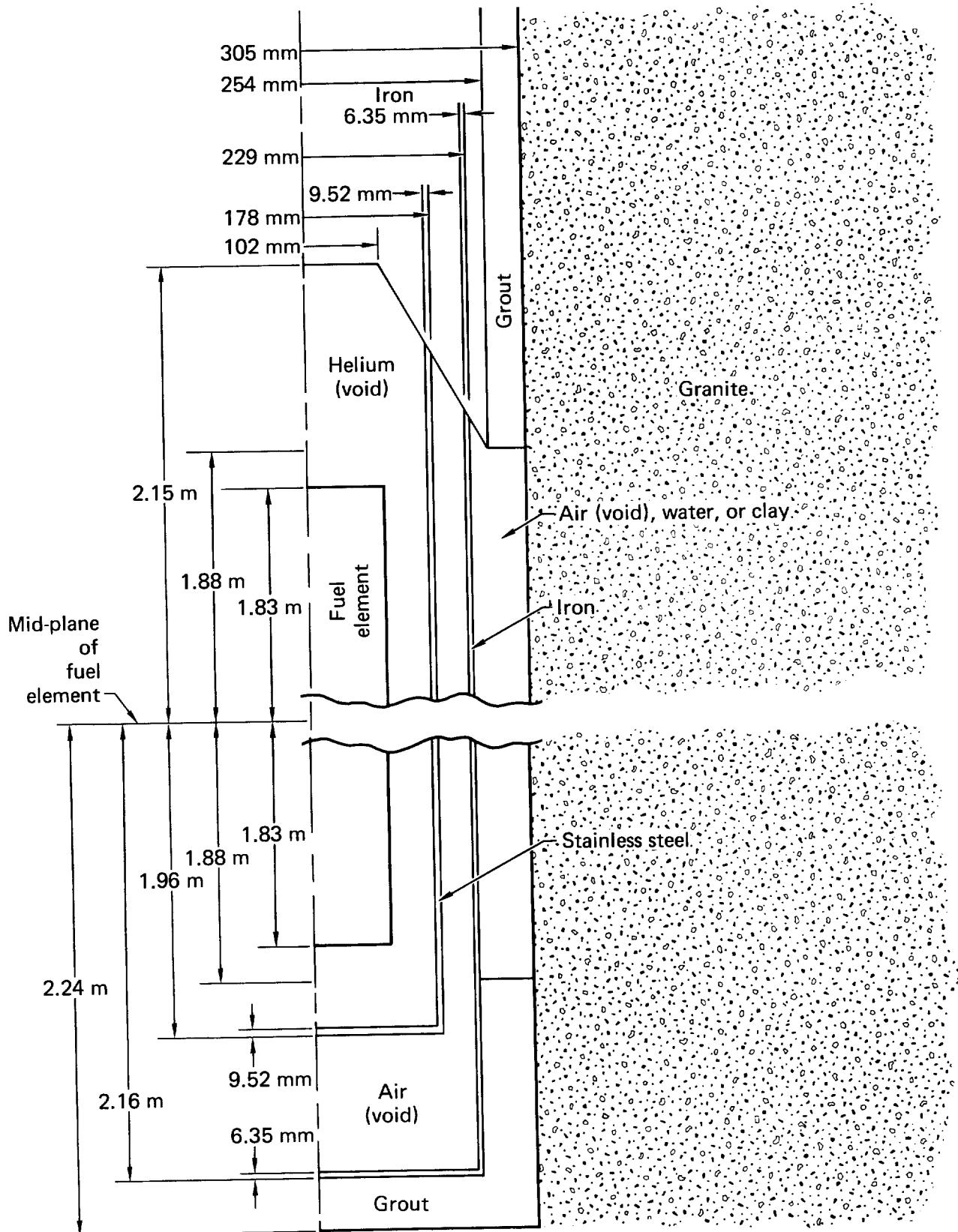
At first glance, it may appear that the dose distribution could be determined relatively easily by hand calculation. Further consideration, however, indicates several complicating factors:

- Each fuel assembly contains enough uranium to produce considerable self-absorption, and several scattering collisions occur before the average gamma ray reaches the granite.
- The nonuniform structure of the fuel element, with both the fuel pins and void gaps between them, complicates the transport of radiation out of the element itself. Because of this structure the flux at the surface of the element will vary with angular position, and this variation will greatly affect the calculated fluxes in the surrounding materials.
- This same structure of the fuel element will cause streaming end effects at both the top and bottom of the element.
- The fuel assembly emits gamma rays and neutrons over considerable energy ranges. The transmission properties of the media vary greatly over these energy ranges.
- Many of the desired results are the fluxes at interfaces between different materials. The hand calculations are not accurate for such interfaces.

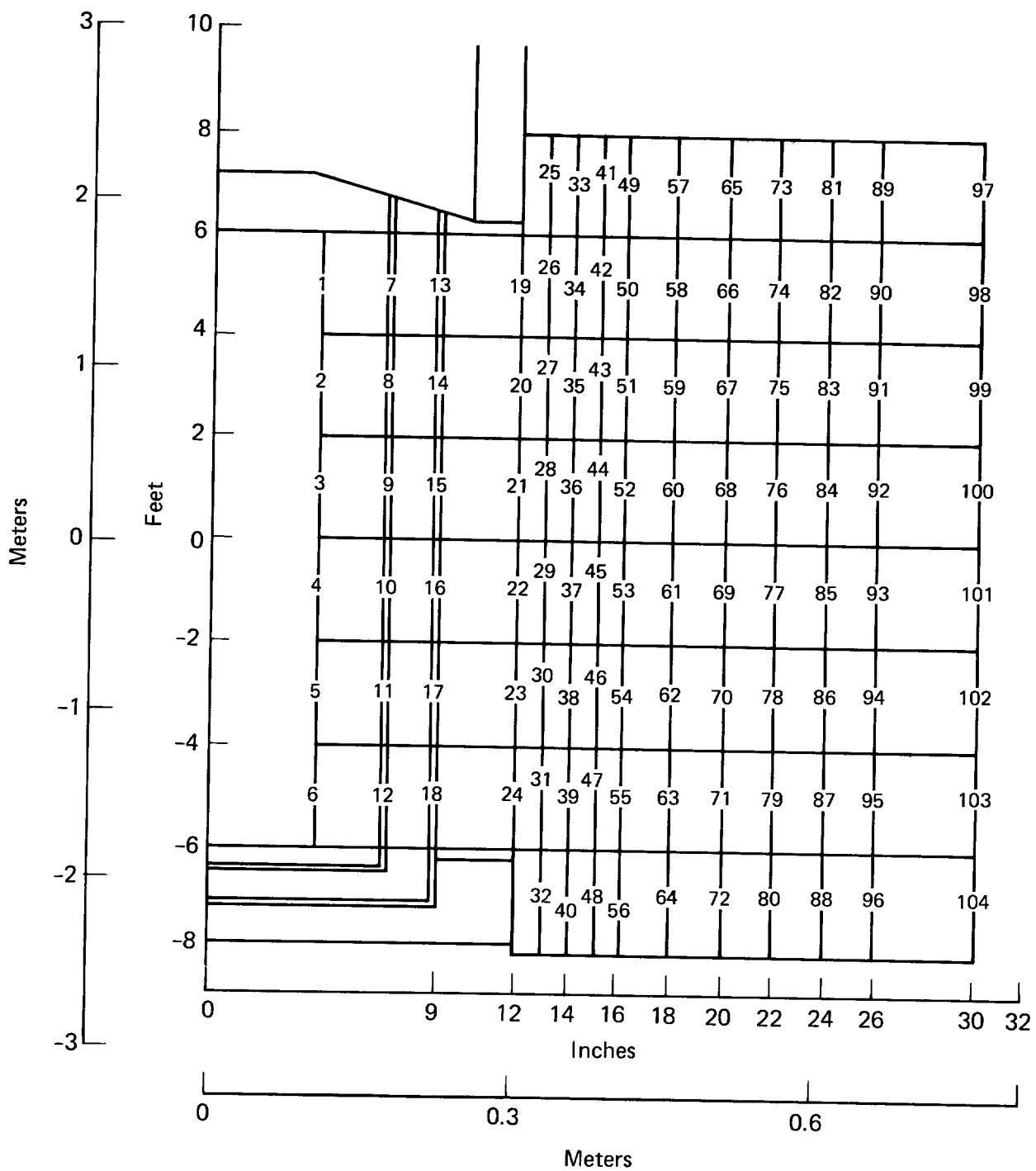
For all these reasons, we decided to use a Monte Carlo calculational approach. Radiation transport calculations for a shipping cask<sup>24</sup> and for a transfer cask, surface storage cask, and dry well<sup>25</sup> for these fuel assemblies have been reported.

## CALCULATIONS

Calculations were performed on a CDC 7600 computer using the MORSE-L Monte Carlo code.<sup>26</sup>



**FIG. 3. Approximate geometry of spent fuel emplacement. Calculations assumed voids rather than air or helium in the actual case; this substitution is indicated by the "void" in parentheses in the figure.**



**FIG. 4.** Boundaries (cf. Tables A1-A15) established for calculation. Note that boundaries 7 through 13 are located on the *outside* surfaces of the canister and liner.

Gamma cross sections used were those of the standard LLNL L-Division 35 group gamma library.<sup>27</sup> With this library, the code follows the history of photons through successive scatters until their energy falls below 150 keV, when they are assumed to be totally absorbed. The general problem

geometry is shown in Fig. 3. The fuel element assembly was modeled exactly as described in the previous discussion, except that the empty tubes were considered to have the same dimensions as the loaded tubes. The radiation source was considered to consist of a uniform volume source in each fueled

TABLE 4. Density and composition of materials subject to irradiation.

Material	Density (g/cm <sup>3</sup> )	Analysis	
		Element	Wt%
$\text{UO}_2$	$0.8972^{12} \times 10.96^{16}$	U	88.1
		O	11.9
Zircaloy-4 <sup>17</sup>	6.60	Zr	98.24
		Sn	1.45
		Fe	0.21
		Cr	0.10
304L Stainless Steel <sup>18,19</sup>	7.90	Fe	68.0
		Cr	19.0
		Ni	10.0
		Mn	2.0
		Si	1.0
Carbon Steel	7.87 <sup>19</sup>	Fe	100.0
Grout <sup>20</sup>	2.0	O	42.5
		Si	40.0
		Ca	15.0
		Fe	1.0
		Al	1.0
		Mg	0.5
Water	1.0	O	88.9
		H	11.1
Compacted bentonite with 10% Water <sup>21</sup>	2.1	O	58.0
		Si	28.0
		Al	10.0
		Fe	2.3
		H	1.7
Sand/bentonite (85%/15% dry) plus 10% water <sup>22</sup>	2.17	O	57.0
		Si	40.0
		Al	1.5
		Fe	0.3
		H	1.2
Granite (Climax Stock quartz monzonite) <sup>23</sup>	2.68	O	52.0
		Si	37.0
		Al	7.0
		Fe	1.0
		Ca	1.0
		Na	1.0
		K	1.0

pin, with the axial intensity distribution shown in Fig. 2. Fluxes were obtained from the Monte Carlo random-walk parameters by using the boundary-crossing technique.<sup>26</sup> Figure 4 indicates the boundaries established in the problem's geometry description. Note that these are 610 mm-high segments on the outside of the fuel element, the outside of the stainless steel and iron containers, the inner surface of the granite, and various calculational surfaces within the granite. It should be noted that the boundary-crossing technique yields the average value of the flux over the area being used.

Separate gamma calculations were made for each of the four radionuclides of interest. The

results were then summed (taking into account the appropriate initial activity of the nuclides and their radioactive decay), to produce results at various times after emplacement. Integrated results were also obtained for the first three years, the following two years, and the complete five-year period.

After the series of problems was run with the gamma sources, the neutron source was modeled, and coupled neutron-gamma MORSE-L problems were run to determine neutron dose rates and secondary gamma dose rates.

The previously described calculations were repeated four times with four different materials in the liner-granite gap.

## RESULTS

In all cases, out to a radius of 762 mm, the neutron dose was negligible compared to the gamma ray dose. Within the statistical uncertainty of the calculation, the dose was independent of vertical location over the central 2.44 m of the fuel assembly. Accordingly, the results for the central 2.44 m were averaged to produce a single result with reduced statistical variation.

The absorbed dose rate results as a function of radius for the central 2.44 m of the fuel assembly are given in Tables 5 through 12 at one-year intervals. The integrated absorbed doses for both granite and LiF as a function of radius for the three time periods are given in Tables 13 through 20. Figures 5 through 8 show plots of the data of Tables 5 through 20, outside the 229 mm radius.

The detailed results are given in Appendix A. Tables A-1 through A-8 show the granite and LiF absorbed dose rate results for each calculational boundary surface at one-year intervals using the four different liner-granite gap materials. Tables A-9 through A-16 show the integrated absorbed doses for all the cases, using the three time periods of interest.

warranted in this case. However, an indication of the magnitude of the overall uncertainty can be gained from an examination of each source.

The first uncertainty is in the concentrations of the radionuclides present in the assembly. Although we do not have a direct evaluation of their uncertainties, we can get some information from the work of Schmittroth et al.,<sup>5</sup> from which the data came. These authors calculated the uncertainty ( $1\sigma$ ) in their estimate of decay heat to be  $\pm 8.6\%$ , taking into account uncertainties in reactor power, irradiation time, burnup, nuclear data, and calculational methods. For assembly number D34, their measured decay heat value was 5.8% lower than their calculated value. The uncertainty in the measurement was estimated at  $\pm 5\%$ . As mentioned above, the four principal gamma emitters considered in our calculation account for most of the measured heat output (about 80%). Therefore, the uncertainties in the nuclide concentrations used for our calculation are probably comparable to the uncertainty in the calculation of decay heat, that is, no greater than about  $\pm 10\%$ .

The next source of uncertainty is the calculation of gamma ray source strengths from the concentrations. The uncertainty in the nuclear data used for this calculation is about  $\pm 5\%$  in the highest case, but generally  $\pm 1\%$  or less.

Neglect of all but four nuclides (or nuclide-pairs) tends to cause the calculation to underestimate the actual doses. The magnitude of this error can also be estimated from the work of Schmittroth et al.<sup>5</sup> As noted, 80% of the measured decay heat comes from the nuclides considered in

## UNCERTAINTY

There are several sources of uncertainty in these results. A complete error analysis would require repeating the Monte Carlo calculations with different sets of input parameters in order to determine the sensitivity of the results to each pertinent parameter. We do not believe such an approach is

TABLE 5. The calculated absorbed dose rate (rad/h to GRANITE) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be VOID.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.70E+04	4.05E+04	3.08E+04	2.46E+04	2.06E+04	1.77E+04	1.66E+04
OUTSIDE SS CANISTER	2.04E+04	1.44E+04	1.09E+04	8.68E+03	7.23E+03	6.23E+03	5.82E+03
OUTSIDE IRON LINER	1.20E+04	8.40E+03	6.33E+03	5.04E+03	4.20E+03	3.62E+03	3.38E+03
SURFACE OF GRANITE	9.42E+03	6.63E+03	5.00E+03	3.98E+03	3.32E+03	2.85E+03	2.67E+03
WITHIN GRANITE							
13 INCH RADIUS	6.68E+03	4.69E+03	3.53E+03	2.81E+03	2.34E+03	2.01E+03	1.87E+03
14 INCH RADIUS	4.20E+03	2.92E+03	2.19E+03	1.73E+03	1.44E+03	1.24E+03	1.15E+03
15 INCH RADIUS	2.79E+03	1.93E+03	1.43E+03	1.13E+03	9.31E+02	7.96E+02	7.41E+02
16 INCH RADIUS	1.82E+03	1.24E+03	9.19E+02	7.22E+02	5.95E+02	5.09E+02	4.74E+02
18 INCH RADIUS	7.76E+02	5.16E+02	3.72E+02	2.87E+02	2.34E+02	1.98E+02	1.83E+02
20 INCH RADIUS	3.24E+02	2.09E+02	1.48E+02	1.13E+02	9.21E+01	7.81E+01	7.25E+01
22 INCH RADIUS	1.42E+02	8.86E+01	6.09E+01	4.56E+01	3.64E+01	3.05E+01	2.82E+01
24 INCH RADIUS	6.03E+01	3.58E+01	2.35E+01	1.68E+01	1.30E+01	1.06E+01	9.63E+00
26 INCH RADIUS	2.75E+01	1.60E+01	1.04E+01	7.52E+00	5.89E+00	4.90E+00	4.52E+00
30 INCH RADIUS	5.44E+00	2.69E+00	1.47E+00	9.03E-01	6.26E-01	4.78E-01	4.27E-01

TABLE 6. The calculated absorbed dose rate (rad/h to GRANITE) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with WATER.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.66E+04	4.03E+04	3.06E+04	2.46E+04	2.06E+04	1.78E+04	1.67E+04
OUTSIDE SS CANISTER	2.03E+04	1.44E+04	1.09E+04	8.66E+03	7.23E+03	6.24E+03	5.83E+03
OUTSIDE IRON LINER	1.25E+04	8.80E+03	6.66E+03	5.32E+03	4.45E+03	3.84E+03	3.59E+03
SURFACE OF GRANITE	6.45E+03	4.51E+03	3.39E+03	2.69E+03	2.23E+03	1.91E+03	1.78E+03
WITHIN GRANITE							
13 INCH RADIUS	4.08E+03	2.83E+03	2.11E+03	1.67E+03	1.38E+03	1.19E+03	1.11E+03
14 INCH RADIUS	2.55E+03	1.81E+03	1.37E+03	1.10E+03	9.17E+02	7.93E+02	7.42E+02
15 INCH RADIUS	1.72E+03	1.18E+03	8.69E+02	6.83E+02	5.64E+02	4.83E+02	4.50E+02
16 INCH RADIUS	1.10E+03	7.37E+02	5.37E+02	4.17E+02	3.41E+02	2.90E+02	2.70E+02
18 INCH RADIUS	4.89E+02	3.21E+02	2.30E+02	1.78E+02	1.45E+02	1.23E+02	1.15E+02
20 INCH RADIUS	1.72E+02	1.06E+02	7.34E+01	5.58E+01	4.56E+01	3.92E+01	3.67E+01
22 INCH RADIUS	8.16E+01	4.87E+01	3.24E+01	2.37E+01	1.87E+01	1.56E+01	1.44E+01
24 INCH RADIUS	3.57E+01	2.01E+01	1.27E+01	9.02E+00	7.00E+00	5.80E+00	5.35E+00
26 INCH RADIUS	1.80E+01	9.58E+00	5.69E+00	3.78E+00	2.78E+00	2.21E+00	2.01E+00
30 INCH RADIUS	3.52E+00	1.64E+00	8.29E-01	4.64E-01	2.93E-01	2.08E-01	1.80E-01

TABLE 7. The calculated absorbed dose rate (rad/h to GRANITE) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with COMPACTED BENTONITE.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.70E+04	4.06E+04	3.08E+04	2.47E+04	2.07E+04	1.79E+04	1.67E+04
OUTSIDE SS CANISTER	2.06E+04	1.45E+04	1.10E+04	8.76E+03	7.30E+03	6.29E+03	5.87E+03
OUTSIDE IRON LINER	1.28E+04	8.99E+03	6.77E+03	5.39E+03	4.49E+03	3.87E+03	3.61E+03
SURFACE OF GRANITE	4.25E+03	2.96E+03	2.21E+03	1.75E+03	1.46E+03	1.25E+03	1.17E+03
WITHIN GRANITE							
13 INCH RADIUS	2.73E+03	1.88E+03	1.40E+03	1.10E+03	9.12E+02	7.82E+02	7.28E+02
14 INCH RADIUS	1.71E+03	1.16E+03	8.58E+02	6.74E+02	5.56E+02	4.76E+02	4.43E+02
15 INCH RADIUS	1.11E+03	7.46E+02	5.45E+02	4.24E+02	3.48E+02	2.96E+02	2.75E+02
16 INCH RADIUS	7.29E+02	4.86E+02	3.52E+02	2.72E+02	2.22E+02	1.88E+02	1.74E+02
18 INCH RADIUS	2.91E+02	1.88E+02	1.33E+02	1.01E+02	8.20E+01	6.93E+01	6.42E+01
20 INCH RADIUS	1.25E+02	7.74E+01	5.31E+01	3.96E+01	3.16E+01	2.64E+01	2.44E+01
22 INCH RADIUS	5.77E+01	3.45E+01	2.28E+01	1.65E+01	1.29E+01	1.06E+01	9.67E+00
24 INCH RADIUS	2.49E+01	1.42E+01	9.08E+00	6.40E+00	4.91E+00	4.00E+00	3.65E+00
26 INCH RADIUS	1.38E+01	7.84E+00	4.89E+00	3.33E+00	2.44E+00	1.90E+00	1.69E+00
30 INCH RADIUS	2.40E+00	1.14E+00	5.88E-01	3.31E-01	2.05E-01	1.39E-01	1.16E-01

TABLE 8. The calculated absorbed dose rate (rad/h to GRANITE) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.66E+04	4.03E+04	3.06E+04	2.46E+04	2.06E+04	1.78E+04	1.67E+04
OUTSIDE SS CANISTER	2.04E+04	1.44E+04	1.09E+04	8.72E+03	7.27E+03	6.27E+03	5.86E+03
OUTSIDE IRON LINER	1.27E+04	8.95E+03	6.75E+03	5.38E+03	4.48E+03	3.86E+03	3.61E+03
SURFACE OF GRANITE	4.07E+03	2.84E+03	2.13E+03	1.69E+03	1.41E+03	1.21E+03	1.13E+03
WITHIN GRANITE							
13 INCH RADIUS	2.62E+03	1.80E+03	1.34E+03	1.06E+03	8.80E+02	7.56E+02	7.05E+02
14 INCH RADIUS	1.65E+03	1.13E+03	8.32E+02	6.54E+02	5.41E+02	4.64E+02	4.32E+02
15 INCH RADIUS	1.05E+03	7.06E+02	5.17E+02	4.04E+02	3.33E+02	2.85E+02	2.66E+02
16 INCH RADIUS	6.80E+02	4.50E+02	3.24E+02	2.51E+02	2.05E+02	1.74E+02	1.61E+02
18 INCH RADIUS	2.98E+02	1.92E+02	1.35E+02	1.03E+02	8.28E+01	6.98E+01	6.46E+01
20 INCH RADIUS	1.32E+02	8.27E+01	5.71E+01	4.27E+01	3.40E+01	2.83E+01	2.61E+01
22 INCH RADIUS	5.46E+01	3.30E+01	2.21E+01	1.62E+01	1.28E+01	1.06E+01	9.75E+00
24 INCH RADIUS	2.51E+01	1.43E+01	9.04E+00	6.37E+00	4.90E+00	4.02E+00	3.68E+00
26 INCH RADIUS	1.22E+01	6.58E+00	3.96E+00	2.66E+00	1.98E+00	1.58E+00	1.43E+00
30 INCH RADIUS	2.73E+00	1.33E+00	7.10E-01	4.28E-01	2.93E-01	2.23E-01	1.99E-01

TABLE 9. The calculated absorbed dose rate (rad/h to LiF) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be VOID.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.28E+04	3.76E+04	2.85E+04	2.28E+04	1.91E+04	1.65E+04	1.54E+04
OUTSIDE SS CANISTER	1.88E+04	1.33E+04	1.00E+04	8.01E+03	6.68E+03	5.76E+03	5.38E+03
OUTSIDE IRON LINER	1.10E+04	7.74E+03	5.83E+03	4.65E+03	3.87E+03	3.34E+03	3.12E+03
SURFACE OF GRANITE	8.67E+03	6.10E+03	4.60E+03	3.66E+03	3.05E+03	2.62E+03	2.45E+03
WITHIN GRANITE							
13 INCH RADIUS	6.14E+03	4.31E+03	3.24E+03	2.58E+03	2.14E+03	1.84E+03	1.72E+03
14 INCH RADIUS	3.86E+03	2.68E+03	2.01E+03	1.59E+03	1.32E+03	1.13E+03	1.06E+03
15 INCH RADIUS	2.56E+03	1.77E+03	1.31E+03	1.03E+03	8.53E+02	7.30E+02	6.79E+02
16 INCH RADIUS	1.67E+03	1.14E+03	8.42E+02	6.61E+02	5.45E+02	4.66E+02	4.34E+02
18 INCH RADIUS	7.11E+02	4.72E+02	3.41E+02	2.63E+02	2.14E+02	1.81E+02	1.68E+02
20 INCH RADIUS	2.97E+02	1.92E+02	1.36E+02	1.04E+02	8.44E+01	7.16E+01	6.65E+01
22 INCH RADIUS	1.32E+02	8.25E+01	5.70E+01	4.29E+01	3.45E+01	2.90E+01	2.69E+01
24 INCH RADIUS	5.59E+01	3.33E+01	2.20E+01	1.59E+01	1.23E+01	1.01E+01	9.22E+00
26 INCH RADIUS	2.54E+01	1.48E+01	9.67E+00	7.00E+00	5.51E+00	4.59E+00	4.25E+00
30 INCH RADIUS	5.07E+00	2.54E+00	1.42E+00	8.93E-01	6.37E-01	4.99E-01	4.52E-01

TABLE 10. The calculated absorbed dose rate (rad/h to LiF) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with WATER.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.24E+04	3.73E+04	2.84E+04	2.28E+04	1.91E+04	1.65E+04	1.55E+04
OUTSIDE SS CANISTER	1.88E+04	1.33E+04	1.00E+04	8.00E+03	6.58E+03	5.76E+03	5.38E+03
OUTSIDE IRON LINER	1.15E+04	8.11E+03	6.13E+03	4.90E+03	4.09E+03	3.53E+03	3.31E+03
SURFACE OF GRANITE	5.92E+03	4.14E+03	3.11E+03	2.47E+03	2.05E+03	1.76E+03	1.64E+03
WITHIN GRANITE							
13 INCH RADIUS	3.56E+03	2.42E+03	1.76E+03	1.36E+03	1.10E+03	9.24E+02	8.53E+02
14 INCH RADIUS	2.34E+03	1.66E+03	1.26E+03	1.01E+03	8.40E+02	7.26E+02	6.79E+02
15 INCH RADIUS	1.58E+03	1.08E+03	7.96E+02	6.25E+02	5.16E+02	4.42E+02	4.12E+02
16 INCH RADIUS	1.01E+03	6.76E+02	4.92E+02	3.82E+02	3.13E+02	2.66E+02	2.47E+02
18 INCH RADIUS	4.48E+02	2.94E+02	2.11E+02	1.63E+02	1.33E+02	1.13E+02	1.05E+02
20 INCH RADIUS	1.81E+02	1.15E+02	7.96E+01	5.99E+01	4.80E+01	4.03E+01	3.73E+01
22 INCH RADIUS	7.48E+01	4.46E+01	2.96E+01	2.16E+01	1.70E+01	1.42E+01	1.31E+01
24 INCH RADIUS	3.28E+01	1.85E+01	1.17E+01	8.25E+00	6.40E+00	5.30E+00	4.89E+00
26 INCH RADIUS	1.65E+01	8.78E+00	5.20E+00	3.45E+00	2.54E+00	2.02E+00	1.83E+00
30 INCH RADIUS	3.14E+00	1.44E+00	7.13E-01	3.94E-01	2.51E-01	1.81E-01	1.59E-01

TABLE 11. The calculated absorbed dose rate (rad/h to LiF) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with COMPACTED BENTONITE.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.29E+04	3.76E+04	2.86E+04	2.29E+04	1.92E+04	1.66E+04	1.55E+04
OUTSIDE SS CANISTER	1.90E+04	1.34E+04	1.01E+04	8.09E+03	6.74E+03	5.80E+03	5.42E+03
OUTSIDE IRON LINER	1.18E+04	8.28E+03	6.24E+03	4.97E+03	4.14E+03	3.56E+03	3.33E+03
SURFACE OF GRANITE	3.90E+03	2.71E+03	2.03E+03	1.61E+03	1.33E+03	1.15E+03	1.07E+03
WITHIN GRANITE							
13 INCH RADIUS	2.50E+03	1.72E+03	1.28E+03	1.01E+03	8.35E+02	7.16E+02	6.67E+02
14 INCH RADIUS	1.56E+03	1.07E+03	7.86E+02	6.17E+02	5.09E+02	4.35E+02	4.05E+02
15 INCH RADIUS	1.02E+03	6.83E+02	4.99E+02	3.88E+02	3.18E+02	2.71E+02	2.52E+02
16 INCH RADIUS	6.68E+02	4.45E+02	3.22E+02	2.49E+02	2.03E+02	1.72E+02	1.59E+02
18 INCH RADIUS	2.67E+02	1.72E+02	1.22E+02	9.27E+01	7.50E+01	6.34E+01	5.88E+01
20 INCH RADIUS	1.15E+02	7.14E+01	4.91E+01	3.67E+01	2.94E+01	2.46E+01	2.28E+01
22 INCH RADIUS	5.40E+01	3.27E+01	2.19E+01	1.61E+01	1.27E+01	1.06E+01	9.73E+00
24 INCH RADIUS	2.30E+01	1.32E+01	8.42E+00	5.96E+00	4.59E+00	3.75E+00	3.43E+00
26 INCH RADIUS	1.28E+01	7.26E+00	4.55E+00	3.12E+00	2.30E+00	1.80E+00	1.61E+00
30 INCH RADIUS	2.26E+00	1.10E+00	5.85E-01	3.46E-01	2.30E-01	1.67E-01	1.45E-01

TABLE 12. The calculated absorbed dose rate (rad/h to LiF) at several calculational surfaces and at various elapsed times since discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
OUTSIDE ELEMENT	5.24E+04	3.73E+04	2.84E+04	2.28E+04	1.91E+04	1.65E+04	1.55E+04
OUTSIDE SS CANISTER	1.89E+04	1.33E+04	1.01E+04	8.05E+03	6.71E+03	5.79E+03	5.41E+03
OUTSIDE IRON LINER	1.17E+04	8.24E+03	6.22E+03	4.96E+03	4.13E+03	3.56E+03	3.32E+03
SURFACE OF GRANITE	3.74E+03	2.60E+03	1.95E+03	1.55E+03	1.29E+03	1.11E+03	1.04E+03
WITHIN GRANITE							
13 INCH RADIUS	2.40E+03	1.65E+03	1.23E+03	9.72E+02	8.06E+02	6.92E+02	6.46E+02
14 INCH RADIUS	1.51E+03	1.03E+03	7.61E+02	5.99E+02	4.95E+02	4.24E+02	3.96E+02
15 INCH RADIUS	9.62E+02	6.47E+02	4.73E+02	3.70E+02	3.05E+02	2.61E+02	2.43E+02
16 INCH RADIUS	6.23E+02	4.12E+02	2.97E+02	2.29E+02	1.87E+02	1.59E+02	1.48E+02
18 INCH RADIUS	2.73E+02	1.75E+02	1.24E+02	9.38E+01	7.57E+01	6.37E+01	5.90E+01
20 INCH RADIUS	1.21E+02	7.56E+01	5.22E+01	3.90E+01	3.10E+01	2.58E+01	2.38E+01
22 INCH RADIUS	5.00E+01	3.02E+01	2.02E+01	1.48E+01	1.17E+01	9.67E+00	8.90E+00
24 INCH RADIUS	2.30E+01	1.31E+01	8.28E+00	5.83E+00	4.48E+00	3.67E+00	3.36E+00
26 INCH RADIUS	1.12E+01	6.05E+00	3.64E+00	2.44E+00	1.81E+00	1.44E+00	1.31E+00
30 INCH RADIUS	2.51E+00	1.22E+00	6.51E-01	3.92E-01	2.67E-01	2.03E-01	1.81E-01

TABLE 13. The calculated absorbed dose (rad to GRANITE) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be VOID.

	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	9.67E+08	1.33E+09	3.61E+08
OUTSIDE SS CANISTER	3.44E+08	4.71E+08	1.27E+08
OUTSIDE IRON LINER	2.00E+08	2.74E+08	7.38E+07
SURFACE OF GRANITE	1.58E+08	2.16E+08	5.83E+07
WITHIN GRANITE			
13 INCH RADIUS	1.12E+08	1.53E+08	4.11E+07
14 INCH RADIUS	6.96E+07	9.49E+07	2.53E+07
15 INCH RADIUS	4.58E+07	6.22E+07	1.64E+07
16 INCH RADIUS	2.96E+07	4.00E+07	1.05E+07
18 INCH RADIUS	1.22E+07	1.63E+07	4.11E+06
20 INCH RADIUS	4.94E+06	6.56E+06	1.62E+06
22 INCH RADIUS	2.08E+06	2.72E+06	6.43E+05
24 INCH RADIUS	8.34E+05	1.06E+06	2.30E+05
26 INCH RADIUS	3.74E+05	4.78E+05	1.04E+05
30 INCH RADIUS	6.16E+04	7.28E+04	1.13E+04

**TABLE 14.** The calculated absorbed dose (rad to GRANITE) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with WATER.

	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	9.62E+08	1.32E+09	3.62E+08
OUTSIDE SS CANISTER	3.42E+08	4.70E+08	1.27E+08
OUTSIDE IRON LINER	2.10E+08	2.88E+08	7.81E+07
SURFACE OF GRANITE	1.07E+08	1.47E+08	3.92E+07
WITHIN GRANITE			
13 INCH RADIUS	6.73E+07	9.16E+07	2.43E+07
14 INCH RADIUS	4.32E+07	5.93E+07	1.61E+07
15 INCH RADIUS	2.79E+07	3.79E+07	9.92E+06
16 INCH RADIUS	1.75E+07	2.35E+07	6.01E+06
18 INCH RADIUS	7.59E+06	1.01E+07	2.56E+06
20 INCH RADIUS	2.51E+06	3.31E+06	8.06E+05
22 INCH RADIUS	1.14E+06	1.47E+06	3.30E+05
24 INCH RADIUS	4.69E+05	5.93E+05	1.24E+05
26 INCH RADIUS	2.21E+05	2.70E+05	4.96E+04
30 INCH RADIUS	3.73E+04	4.26E+04	5.35E+03

TABLE 15. The calculated absorbed dose (rad to GRANITE) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with COMPACTED BEN-TONITE.

	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	9.69E+08	1.33E+09	3.63E+08
OUTSIDE SS CANISTER	3.47E+08	4.75E+08	1.28E+08
OUTSIDE IRON LINER	2.14E+08	2.93E+08	7.90E+07
SURFACE OF GRANITE	7.04E+07	9.60E+07	2.56E+07
WITHIN GRANITE			
13 INCH RADIUS	4.47E+07	6.08E+07	1.60E+07
14 INCH RADIUS	2.76E+07	3.74E+07	9.78E+06
15 INCH RADIUS	1.77E+07	2.38E+07	6.12E+06
16 INCH RADIUS	1.15E+07	1.54E+07	3.90E+06
18 INCH RADIUS	4.43E+06	5.87E+06	1.44E+06
20 INCH RADIUS	1.82E+06	2.37E+06	5.57E+05
22 INCH RADIUS	8.05E+05	1.03E+06	2.27E+05
24 INCH RADIUS	3.31E+05	4.18E+05	8.70E+04
26 INCH RADIUS	1.81E+05	2.24E+05	4.33E+04
30 INCH RADIUS	2.59E+04	2.96E+04	3.73E+03

TABLE 16. The calculated absorbed dose (rad to GRANITE) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	9.62E+08	1.32E+09	3.62E+08
OUTSIDE SS CANISTER	3.44E+08	4.72E+08	1.28E+08
OUTSIDE IRON LINER	2.13E+08	2.92E+08	7.88E+07
SURFACE OF GRANITE	6.76E+07	9.23E+07	2.47E+07
WITHIN GRANITE			
13 INCH RADIUS	4.29E+07	5.84E+07	1.55E+07
14 INCH RADIUS	2.68E+07	3.63E+07	9.51E+06
15 INCH RADIUS	1.68E+07	2.26E+07	5.86E+06
16 INCH RADIUS	1.06E+07	1.42E+07	3.60E+06
18 INCH RADIUS	4.52E+06	5.98E+06	1.46E+06
20 INCH RADIUS	1.94E+06	2.54E+06	5.99E+05
22 INCH RADIUS	7.72E+05	9.98E+05	2.26E+05
24 INCH RADIUS	3.31E+05	4.18E+05	8.70E+04
26 INCH RADIUS	1.52E+05	1.87E+05	3.52E+04
30 INCH RADIUS	3.03E+04	3.56E+04	5.29E+03

TABLE 17. The calculated absorbed dose (rad to LiF) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be VOID.

	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	8.96E+08	1.23E+09	3.35E+08
OUTSIDE SS CANISTER	3.17E+08	4.35E+08	1.17E+08
OUTSIDE IRON LINER	1.85E+08	2.53E+08	6.81E+07
SURFACE OF GRANITE	1.45E+08	1.99E+08	5.36E+07
WITHIN GRANITE			
13 INCH RADIUS	1.03E+08	1.40E+08	3.77E+07
14 INCH RADIUS	6.39E+07	8.71E+07	2.32E+07
15 INCH RADIUS	4.20E+07	5.70E+07	1.50E+07
16 INCH RADIUS	2.71E+07	3.67E+07	9.59E+06
18 INCH RADIUS	1.12E+07	1.49E+07	3.77E+06
20 INCH RADIUS	4.53E+06	6.02E+06	1.49E+06
22 INCH RADIUS	1.94E+06	2.55E+06	6.08E+05
24 INCH RADIUS	7.77E+05	9.95E+05	2.18E+05
26 INCH RADIUS	3.46E+05	4.43E+05	9.75E+04
30 INCH RADIUS	5.83E+04	6.97E+04	1.14E+04

TABLE 18. The calculated absorbed dose (rad to LiF) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with WATER.

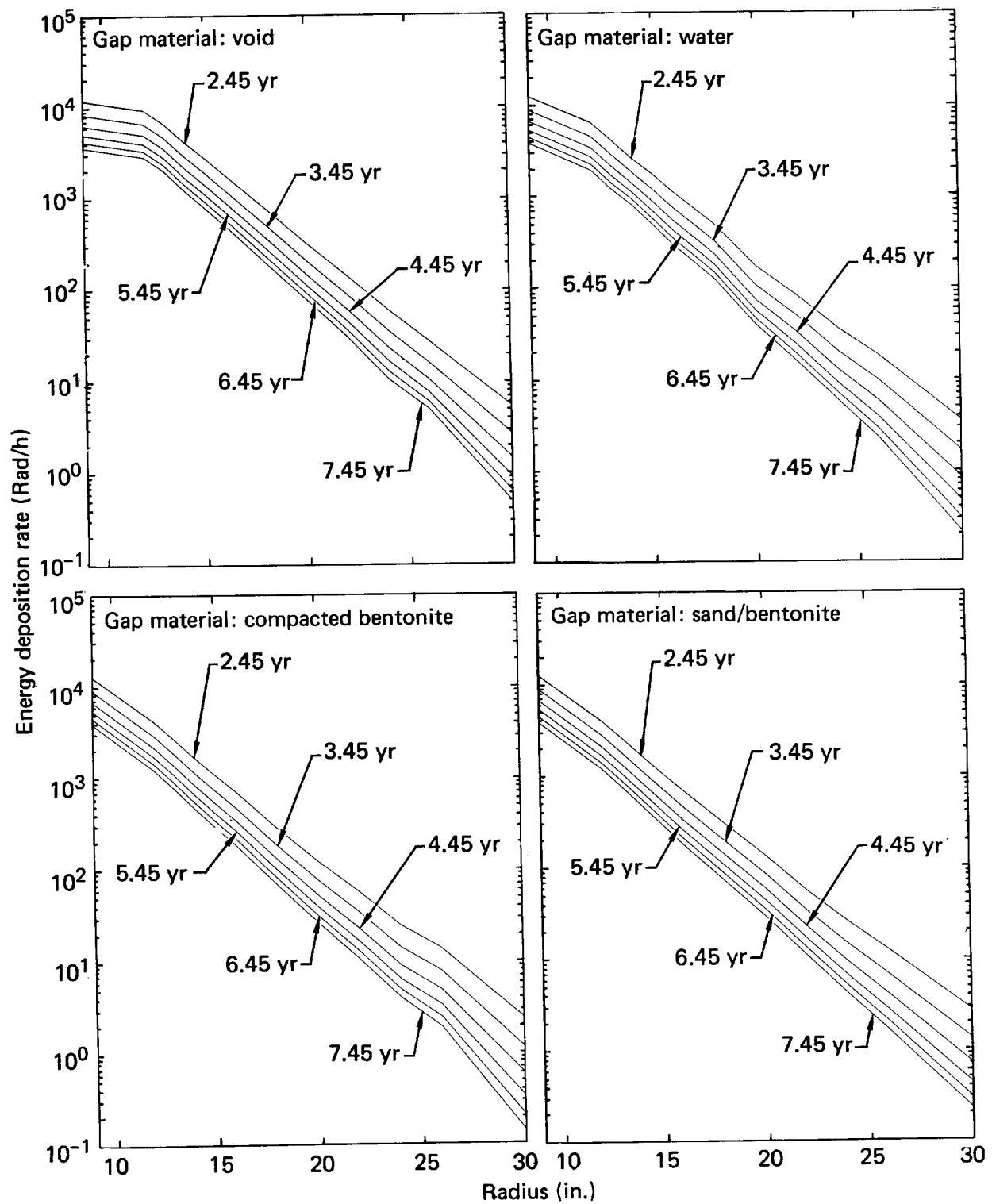
	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	8.92E+08	1.23E+09	3.36E+08
OUTSIDE SS CANISTER	3.16E+08	4.34E+08	1.17E+08
OUTSIDE IRON LINER	1.93E+08	2.65E+08	7.19E+07
SURFACE OF GRANITE	9.87E+07	1.35E+08	3.60E+07
WITHIN GRANITE			
13 INCH RADIUS	5.71E+07	7.65E+07	1.94E+07
14 INCH RADIUS	3.96E+07	5.43E+07	1.48E+07
15 INCH RADIUS	2.56E+07	3.47E+07	9.08E+06
16 INCH RADIUS	1.60E+07	2.15E+07	5.50E+06
18 INCH RADIUS	6.96E+06	9.30E+06	2.34E+06
20 INCH RADIUS	2.69E+06	3.54E+06	8.47E+05
22 INCH RADIUS	1.04E+06	1.34E+06	3.01E+05
24 INCH RADIUS	4.30E+05	5.43E+05	1.14E+05
26 INCH RADIUS	2.02E+05	2.48E+05	4.53E+04
30 INCH RADIUS	3.26E+04	3.72E+04	4.58E+03

TABLE 19. The calculated absorbed dose (rad to LiF) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with COMPACTED BENTONITE.

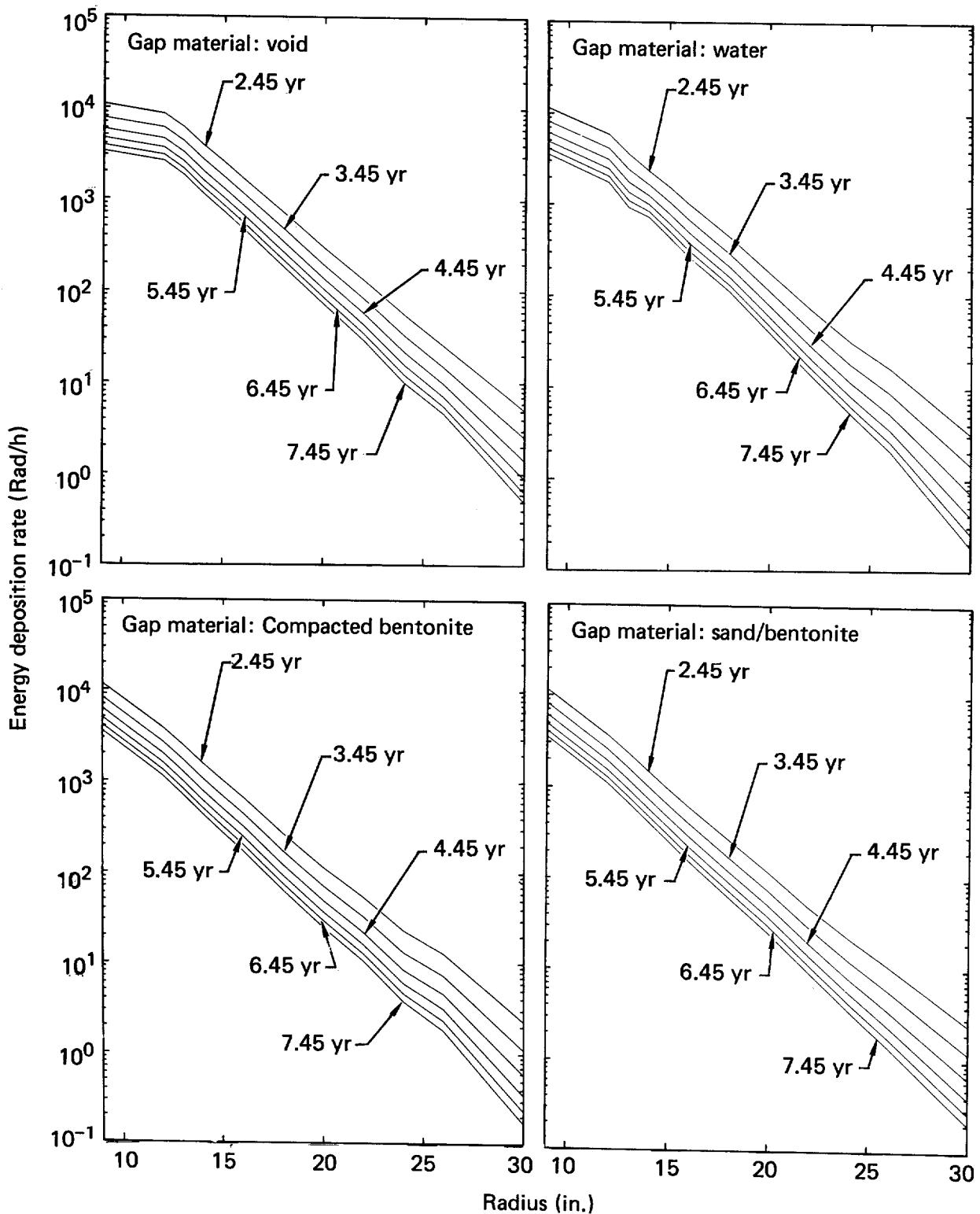
	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	8.98E+08	1.23E+09	3.37E+08
OUTSIDE SS CANISTER	3.20E+08	4.39E+08	1.18E+08
OUTSIDE IRON LINER	1.97E+08	2.70E+08	7.27E+07
SURFACE OF GRANITE	6.46E+07	8.80E+07	2.35E+07
WITHIN GRANITE			
13 INCH RADIUS	4.10E+07	5.57E+07	1.47E+07
14 INCH RADIUS	2.53E+07	3.43E+07	8.95E+06
15 INCH RADIUS	1.62E+07	2.18E+07	5.60E+06
16 INCH RADIUS	1.05E+07	1.41E+07	3.57E+06
18 INCH RADIUS	4.06E+06	5.38E+06	1.32E+06
20 INCH RADIUS	1.68E+06	2.20E+06	5.18E+05
22 INCH RADIUS	7.65E+05	9.89E+05	2.24E+05
24 INCH RADIUS	3.06E+05	3.88E+05	8.13E+04
26 INCH RADIUS	1.68E+05	2.09E+05	4.08E+04
30 INCH RADIUS	2.50E+04	2.92E+04	4.14E+03

**TABLE 20.** The calculated absorbed dose (rad to LiF) at several calculational surfaces and over three time periods after discharge of fuel from reactor. The values are averages over the central 2.44 m (8 ft) of the fuel assembly. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

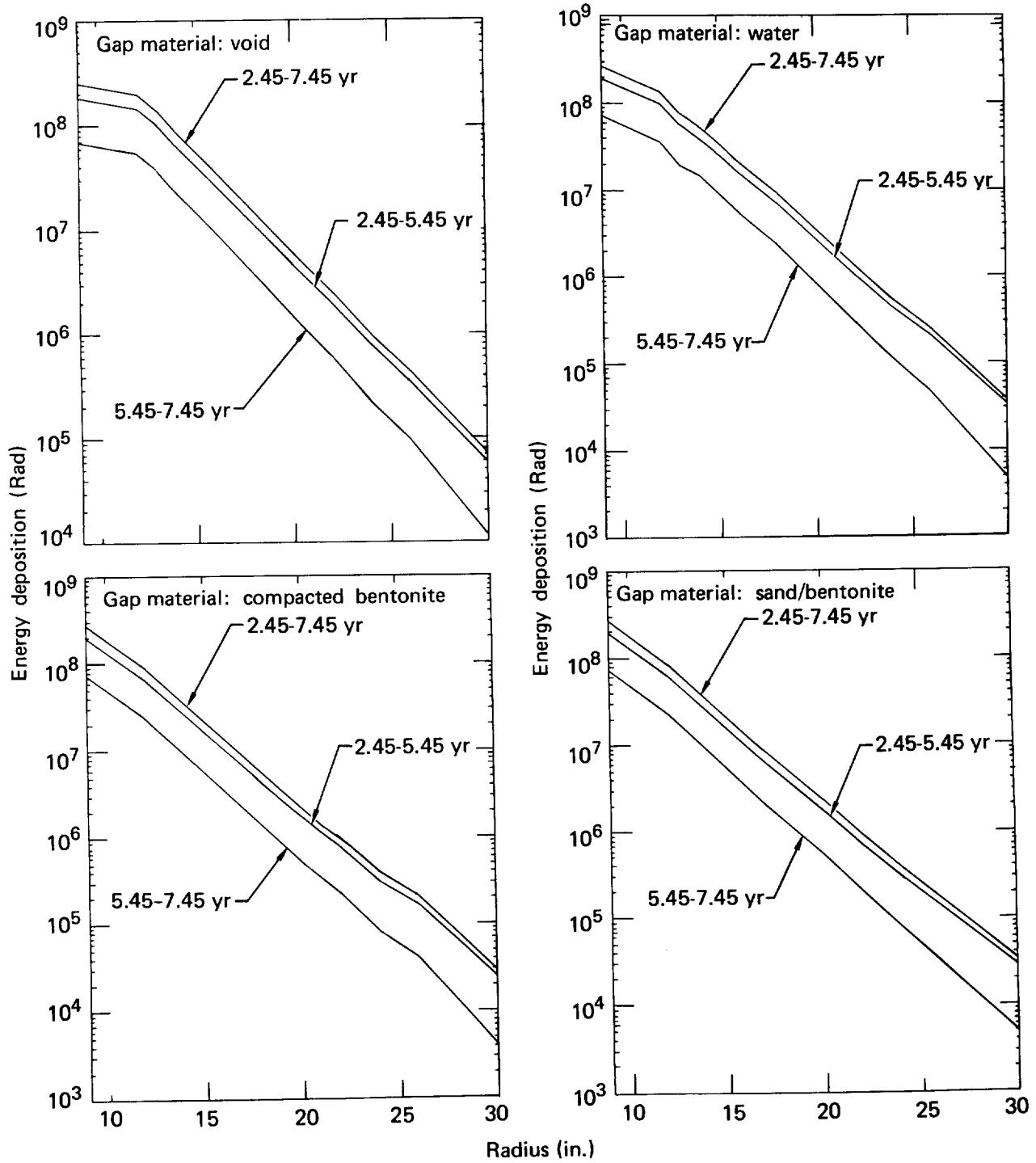
	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
OUTSIDE ELEMENTS	8.92E+08	1.23E+09	3.35E+08
OUTSIDE SS CANISTER	3.18E+08	4.36E+08	1.18E+08
OUTSIDE IRON LINER	1.97E+08	2.69E+08	7.26E+07
SURFACE OF GRANITE	6.20E+07	8.47E+07	2.27E+07
WITHIN GRANITE			
13 INCH RADIUS	3.93E+07	5.35E+07	1.42E+07
14 INCH RADIUS	2.45E+07	3.32E+07	8.71E+06
15 INCH RADIUS	1.54E+07	2.07E+07	5.36E+06
16 INCH RADIUS	9.75E+06	1.30E+07	3.29E+06
18 INCH RADIUS	4.13E+06	5.47E+06	1.33E+06
20 INCH RADIUS	1.78E+06	2.32E+06	5.47E+05
22 INCH RADIUS	7.07E+05	9.13E+05	2.06E+05
24 INCH RADIUS	3.04E+05	3.83E+05	7.94E+04
26 INCH RADIUS	1.40E+05	1.72E+05	3.22E+04
30 INCH RADIUS	2.78E+04	3.27E+04	4.82E+03



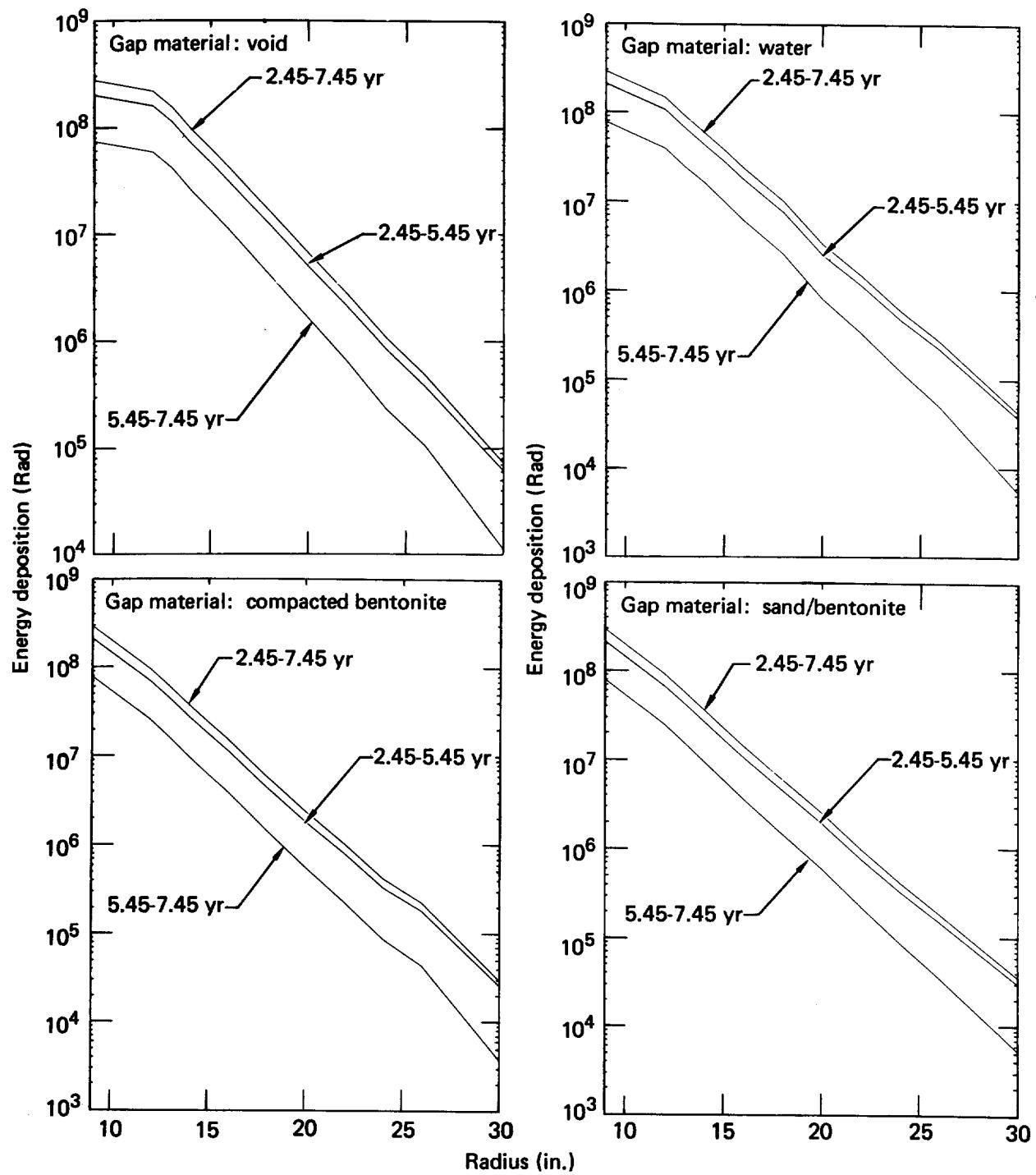
**FIG. 5.** The absorbed dose rate (rad/h to granite) outside the iron liner as a function of radius from the center line of the fuel assembly. The values plotted are averages over the central 2.44 m (8 ft) of the fuel assembly. The gap between the liner and the granite was assumed to be VOID, or filled with WATER or COMPACTED BENTONITE or a SAND/BENTONITE mixture, as shown in the legends of the plots. The parameter is time elapsed since discharge of fuel from reactor.



**FIG. 6.** The absorbed dose rate (rad/h to LiF) outside the iron liner as a function of radius from the center line of the fuel assembly. The values plotted are averages over the central 2.44 m (8 ft) of the fuel assembly. The gap between the liner and the granite was assumed to be VOID, or filled with WATER or COMPACTED BENTONITE or a SAND/BENTONITE mixture, as shown in the legends of the plots. The parameter is time elapsed since discharge of fuel from reactor.



**FIG. 7.** The absorbed dose (rad to granite) outside the iron liner as a function of radius from the center line of the fuel assembly. The values plotted are averages over the central 2.44 m (8 ft) of the fuel assembly. The gap between the liner and the granite was assumed to be VOID, or filled with WATER or COMPACTED BENTONITE or a SAND/BENTONITE mixture, as shown in the legends of the plots. The parameter is time period after discharge of fuel from reactor.



**FIG. 8.** The absorbed dose (rad to LiF) outside the iron liner as a function of radius from the center line of the fuel assembly. The values plotted are averages over the central 2.44 m (8 ft) of the fuel assembly. The gap between the liner and the granite was assumed to be VOID, or filled with WATER or COMPACTED BENTONITE or a SAND/BENTONITE mixture, as shown in the legends of the plots. The parameter is time period after discharge of fuel from reactor.

our calculation. The pair  $^{90}\text{Sr}$ - $^{90}\text{Y}$ , which is essentially a pure beta emitter (i.e., it produces almost no gamma rays), accounts for an additional 10%, approximately. If the ratio of the contribution to the gamma ray dose to the contribution to the decay heat is the same for the remaining nuclides as for those considered, then the neglect of the remaining nuclides might produce a result 10% lower than the actual case.

The axial distribution of source strength was entered into the calculation as a histogram, as noted above. The  $^{137}\text{Cs}$  scans from which this approximation was made actually show variations of about  $\pm 5\%$  along the central section of the full assembly, where the source strength was approximated as constant for our calculations. Since we averaged over the entire central 2.44 m, this approximation should not cause a significant error. The use of (discrete) histograms at the ends of the assembly instead of the (continuous) cosine curves predicted by reactor theory should likewise not produce significant error in the results for central section.

Another source of error was neglect of the spacer grids, nozzles, and support cage. The gross gamma scans in the HEDL report<sup>4</sup> showed decreases of about 10% at the spacer grids. The  $^{137}\text{Cs}$  scans, which were performed with an energy window around 0.66 MeV, showed decreases about half as large, probably because these gamma rays suffered less attenuation than did the lower-energy gammas included in the total-gamma scans. Because we averaged over the entire central section, the lack of attenuation due to neglecting the spacer grids will tend to cause our result to be slightly higher than the actual case. This effect is probably less than 1%. Neglect of the nozzles at top and bottom should not have a significant effect on the central section. Neglect of the support cage will tend to make our result higher than actual by less than 10%. This figure was estimated by smearing the support cage over the entire external surface of the assembly and calculating attenuation of a 0.6-MeV gamma ray in the resulting thickness of stainless steel.

The simplification of the shield plug geometry in the model should not produce significant effects in the central section of the granite.

No doubt there are deviations in axial alignment between the steel liners and the holes in the granite. The effect of this will be to increase the dose to the granite in the areas where the fuel assembly is closer to the wall of the hole than in the ideal

geometry modeled and *vice versa*. If the liner were tilted with respect to the hole, such that a 50 mm change in spacing between the assembly and the granite wall occurred, the gamma dose at the surface of the granite could vary as much as 10-15% from the dose calculated with the ideal geometry of the model.

Uncertainty in position of the grout could also influence the results. For example, if extra grout were placed in the liner-granite gap, part of the central section of the granite would be shielded by it.

Variation in properties of materials could also have an effect on dose. The density and composition of the granite itself varies to some degree. Presence of joints, open or filled with other minerals of different density and composition, will affect the dose. These effects might amount to a few percent.

The MORSE-L code itself contains uncertainties in the cross sections, but these are generally quite low for gamma ray interactions. In addition, a small error arises from the fact that the gamma rays are treated by energy groups, rather than discrete energies. Another error arises from the assumption that the gamma rays are totally absorbed when their energy falls below 150 keV. The mean free path of a 150-keV gamma ray in the granite is about 27 mm, and the cross section for the granite at this energy is overwhelmingly dominated by Compton scattering. Therefore, the gamma rays which we assume to be absorbed at 150 keV actually would be expected to travel distances of tens of millimeters more and undergo several scatters before they are finally absorbed. However, this effect is ameliorated by the fact that by the time a 600-keV gamma ray (approximately the dominant energy emitted by the fuel) has its energy reduced to below 150 keV, it has undergone several scatters, so that its direction of travel is less likely to be radially outward. In addition, the Klein-Nishina cross section for Compton scattering becomes more nearly isotropic at lower energies, so that lower-energy gamma rays tend to be more nearly isotropic in their directions of travel. Consequently, although this calculation tends to estimate the dose to be somewhat higher than actual because of its 150 keV cut-off, the error would not be significant. An accurate estimate of the error would require comparing the results of additional calculations with different values of the cut-off.

A final source of uncertainty is due to the statistical uncertainty inherent in Monte Carlo calculations. We estimate the statistical uncertainty,

averaged over the central 2.44 m of the assembly, to be  $\pm 2\%$  at the inner locations and  $\pm 7\%$  at points 0.610 m from the centerline.

In conclusion, we estimate that the results calculated here are probably within  $\pm 25\%$  of the ac-

tual values. A more accurate estimate of uncertainty would require more extensive calculations than appear to be warranted for present purposes.

## DISCUSSION

The general features of the results are as one would expect from basic considerations and are in agreement with available experimental measurements. First of all, the magnitude of the absorbed dose rate at the surface of assembly D34, averaged over the central 2.44 m, is calculated to be 0.147 Gy/s ( $5.28 \times 10^4$  rad/h) for LiF and an age of 2.45 y. R. B. Davis of HEDL has reported measurements of exposure dose rate on assembly D04 in a hot cell on Sept. 12, 1979, prior to emplacement.<sup>4</sup> The average of eight unshielded positions in the portion corresponding to the flat region in Fig. 2 was  $9.11 \times 10^4$  R/h, which is equivalent to an absorbed dose rate of about 0.21 Gy/s in LiF. Adjusting our calculation for this same age and fuel element, we obtain .211 Gy/s ( $7.6 \times 10^4$  rad/h). When we consider the uncertainties mentioned above, and the fact that the scattering environments are different, this excellent agreement should be regarded as fortuitous.

The decrease in dose rate with radius in the gap between the liner and the granite ( $r = 229\text{--}305$  mm) is seen to be greater the higher the density of the material assumed to be filling this space, as expected.

The drop-off in dose rate with radius in the granite ( $r = 229\text{--}305$  mm) is essentially linear on the semilog plot, which one would expect from the exponential attenuation of gamma rays. Actually, the top curve in Fig. 6, which appears to have the least statistical variation of all the curves, can better be fitted by a product of  $1/r$  and  $e^{-\mu r}$  terms, but the exponential term is dominant for the range in radius of interest, so that a straight line is a good approximation. The "build-up" effect due to gamma ray scattering does not appear to change the shape of the curves, though it undoubtedly affects the slopes.

It is of interest to estimate how much of the total heat output of the fuel assembly is deposited in the granite in the form of gamma rays. This can be done by fitting the dose rate by a function of the

form  $Ae^{-\mu r}/r$  and integrating over the volume of the granite from the inside surface of the hole to infinite radius. For the case of a void in the liner-granite gap, the result is about 40 W, which is less than 3% of the total heat output. It can thus be seen that the gamma-deposited heat is a small perturbation on the total heat input to the granite surface by the conventional heat transport mechanisms.

The decrease in dose rate with time results from decay of the nuclides of interest. The more negative slopes of the curves at higher ages reflect the softening of the gamma ray spectrum as decay proceeds, since the higher-energy gamma rays are emitted by the shorter-lived nuclides.

The undulations in the curves within the granite can be attributed to statistical error in the Monte Carlo calculations.

The dose rate in granite is seen to be about 8% higher than the dose rate in LiF for the same locations. This is a result of the difference in gamma ray absorption cross sections for the elements they contain.

The independence of dose rate with vertical location over most of the length of the assembly can be explained by the large length-to-radius ratio and the large length-to-mean-free-path ratio of the configuration modeled.

The variation of dose rate with time over the time period of interest appears to be fitted well by an equation having the time dependence  $t^n$ , where the precise value of  $n$  is different for each location and absorbing material. For the inside surface of the granite hole,  $n$  is about 1.1 for all four absorbing materials. It appears that to match the doses calculated here to the measured doses, and to correct for different emplacement times, the best procedure to use is as follows: first calculate  $n$  for the location of interest by fitting calculated points, then integrate the resulting equation for dose rate over the time period used for dosimetry.

## CONCLUSIONS

Radiation doses have been calculated for geologic materials surrounding spent fuel emplacement holes in the Climax Stock quartz monzonite. The radiation dose to the granite is essentially all due to gamma irradiation. The maximum dose oc-

curs at the inside surface of the holes. Over a five-year period, with air in the liner-granite gap, the dose is about 2.2 MGy ( $2.2 \times 10^8$  rad). For other cases, the dose to the granite is less than this figure.

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**Appendix A.**  
**Detailed results**

TABLE A1. The calculated absorbed dose rate (rad/h to GRANITE) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be VOID.

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
1	4.50E+04	3.19E+04	2.41E+04	1.92E+04	1.60E+04	1.38E+04	1.29E+04
2	5.50E+04	3.90E+04	2.95E+04	2.36E+04	1.96E+04	1.69E+04	1.58E+04
3	5.67E+04	4.04E+04	3.07E+04	2.46E+04	2.06E+04	1.78E+04	1.67E+04
4	5.90E+04	4.17E+04	3.15E+04	2.51E+04	2.09E+04	1.80E+04	1.68E+04
5	5.73E+04	4.10E+04	3.13E+04	2.51E+04	2.11E+04	1.83E+04	1.71E+04
6	4.67E+04	3.30E+04	2.50E+04	2.00E+04	1.67E+04	1.44E+04	1.34E+04
7	1.65E+04	1.16E+04	8.67E+03	6.85E+03	5.66E+03	4.83E+03	4.49E+03
8	2.02E+04	1.43E+04	1.08E+04	8.64E+03	7.21E+03	6.23E+03	5.82E+03
9	2.05E+04	1.45E+04	1.10E+04	8.78E+03	7.33E+03	6.34E+03	5.92E+03
10	2.05E+04	1.44E+04	1.09E+04	8.64E+03	7.18E+03	6.16E+03	5.75E+03
11	2.04E+04	1.44E+04	1.09E+04	8.66E+03	7.21E+03	6.21E+03	5.80E+03
12	1.70E+04	1.20E+04	9.03E+03	7.20E+03	6.01E+03	5.18E+03	4.84E+03
13	9.29E+03	6.52E+03	4.89E+03	3.87E+03	3.20E+03	2.74E+03	2.55E+03
14	1.17E+04	8.23E+03	6.21E+03	4.96E+03	4.14E+03	3.58E+03	3.35E+03
15	1.22E+04	8.56E+03	6.47E+03	5.17E+03	4.31E+03	3.72E+03	3.48E+03
16	1.20E+04	8.39E+03	6.31E+03	5.01E+03	4.17E+03	3.59E+03	3.35E+03
17	1.20E+04	8.42E+03	6.33E+03	5.03E+03	4.18E+03	3.59E+03	3.35E+03
18	1.00E+04	7.01E+03	5.27E+03	4.19E+03	3.49E+03	3.00E+03	2.80E+03
19	6.91E+03	4.85E+03	3.64E+03	2.88E+03	2.39E+03	2.05E+03	1.91E+03
20	9.31E+03	6.60E+03	5.00E+03	4.00E+03	3.35E+03	2.89E+03	2.71E+03
21	9.52E+03	6.69E+03	5.03E+03	4.00E+03	3.33E+03	2.86E+03	2.67E+03
22	9.35E+03	6.58E+03	4.97E+03	3.96E+03	3.30E+03	2.85E+03	2.66E+03
23	9.49E+03	6.66E+03	5.00E+03	3.96E+03	3.28E+03	2.81E+03	2.62E+03
24	7.64E+03	5.39E+03	4.06E+03	3.23E+03	2.68E+03	2.30E+03	2.15E+03
25	3.85E+02	2.66E+02	1.98E+02	1.56E+02	1.30E+02	1.12E+02	1.04E+02
26	4.62E+03	3.23E+03	2.42E+03	1.91E+03	1.59E+03	1.36E+03	1.27E+03
27	6.27E+03	4.39E+03	3.30E+03	2.63E+03	2.19E+03	1.89E+03	1.77E+03
28	6.75E+03	4.73E+03	3.55E+03	2.82E+03	2.34E+03	2.01E+03	1.87E+03
29	7.21E+03	5.10E+03	3.84E+03	3.05E+03	2.53E+03	2.17E+03	2.02E+03
30	6.49E+03	4.56E+03	3.44E+03	2.74E+03	2.28E+03	1.96E+03	1.83E+03
31	5.28E+03	3.71E+03	2.79E+03	2.22E+03	1.85E+03	1.59E+03	1.48E+03
32	4.67E+02	3.24E+02	2.43E+02	1.95E+02	1.65E+02	1.44E+02	1.35E+02
33	2.48E+02	1.66E+02	1.21E+02	9.49E+01	7.84E+01	6.74E+01	6.29E+01
34	3.16E+03	2.19E+03	1.63E+03	1.28E+03	1.06E+03	9.07E+02	8.44E+02
35	4.02E+03	2.79E+03	2.08E+03	1.65E+03	1.37E+03	1.18E+03	1.10E+03

TABLE A1. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	4.30E+03	3.01E+03	2.26E+03	1.80E+03	1.50E+03	1.29E+03	1.21E+03
37	4.23E+03	2.94E+03	2.20E+03	1.74E+03	1.44E+03	1.24E+03	1.16E+03
38	4.25E+03	2.96E+03	2.21E+03	1.74E+03	1.44E+03	1.23E+03	1.15E+03
39	3.44E+03	2.38E+03	1.78E+03	1.41E+03	1.17E+03	1.01E+03	9.43E+02
40	2.90E+02	1.96E+02	1.45E+02	1.15E+02	9.64E+01	8.37E+01	7.86E+01
41	1.63E+02	1.12E+02	8.38E+01	6.69E+01	5.62E+01	4.89E+01	4.60E+01
42	1.99E+03	1.37E+03	1.02E+03	7.98E+02	6.57E+02	5.60E+02	5.21E+02
43	2.69E+03	1.85E+03	1.37E+03	1.08E+03	8.94E+02	7.66E+02	7.13E+02
44	2.85E+03	1.97E+03	1.47E+03	1.17E+03	9.66E+02	8.29E+02	7.73E+02
45	2.75E+03	1.89E+03	1.40E+03	1.10E+03	9.08E+02	7.76E+02	7.22E+02
46	2.88E+03	1.99E+03	1.48E+03	1.16E+03	9.56E+02	8.15E+02	7.58E+02
47	2.30E+03	1.58E+03	1.17E+03	9.23E+02	7.63E+02	6.53E+02	6.08E+02
48	1.99E+02	1.34E+02	9.93E+01	7.89E+01	6.62E+01	5.77E+01	5.42E+01
49	1.04E+02	6.63E+01	4.63E+01	3.50E+01	2.80E+01	2.35E+01	2.17E+01
50	1.36E+03	9.30E+02	6.83E+02	5.32E+02	4.36E+02	3.70E+02	3.43E+02
51	1.72E+03	1.18E+03	8.75E+02	6.90E+02	5.73E+02	4.93E+02	4.60E+02
52	1.87E+03	1.27E+03	9.41E+02	7.38E+02	6.09E+02	5.20E+02	4.85E+02
53	1.80E+03	1.23E+03	9.10E+02	7.14E+02	5.89E+02	5.04E+02	4.69E+02
54	1.88E+03	1.29E+03	9.52E+02	7.44E+02	6.10E+02	5.18E+02	4.80E+02
55	1.46E+03	9.80E+02	7.15E+02	5.56E+02	4.55E+02	3.87E+02	3.59E+02
56	1.32E+02	9.00E+01	6.75E+01	5.43E+01	4.61E+01	4.05E+01	3.83E+01
57	4.12E+01	2.64E+01	1.87E+01	1.43E+01	1.16E+01	9.82E+00	9.12E+00
58	5.61E+02	3.71E+02	2.66E+02	2.04E+02	1.65E+02	1.39E+02	1.29E+02
59	7.98E+02	5.33E+02	3.87E+02	3.00E+02	2.44E+02	2.07E+02	1.92E+02
60	7.51E+02	4.93E+02	3.53E+02	2.71E+02	2.20E+02	1.87E+02	1.73E+02
61	7.46E+02	4.95E+02	3.56E+02	2.73E+02	2.22E+02	1.87E+02	1.73E+02
62	8.08E+02	5.41E+02	3.93E+02	3.04E+02	2.48E+02	2.11E+02	1.95E+02
63	6.25E+02	4.16E+02	3.01E+02	2.33E+02	1.91E+02	1.63E+02	1.51E+02
64	6.65E+01	4.39E+01	3.17E+01	2.46E+01	2.02E+01	1.73E+01	1.61E+01
65	1.83E+01	1.15E+01	7.91E+00	5.93E+00	4.74E+00	3.98E+00	3.67E+00
66	2.41E+02	1.52E+02	1.06E+02	8.03E+01	6.46E+01	5.44E+01	5.04E+01
67	3.42E+02	2.18E+02	1.53E+02	1.16E+02	9.45E+01	8.02E+01	7.45E+01
68	3.07E+02	1.99E+02	1.42E+02	1.10E+02	8.99E+01	7.70E+01	7.18E+01
69	3.07E+02	1.98E+02	1.39E+02	1.05E+02	8.47E+01	7.11E+01	6.57E+01
70	3.40E+02	2.23E+02	1.59E+02	1.22E+02	9.95E+01	8.43E+01	7.82E+01

TABLE A1. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
71	2.99E+02	1.94E+02	1.38E+02	1.05E+02	8.42E+01	7.07E+01	6.53E+01
72	2.74E+01	1.79E+01	1.30E+01	1.03E+01	8.67E+00	7.60E+00	7.17E+00
73	6.10E+00	3.51E+00	2.24E+00	1.56E+00	1.18E+00	9.49E-01	8.60E-01
74	1.03E+02	6.31E+01	4.27E+01	3.14E+01	2.47E+01	2.05E+01	1.88E+01
75	1.57E+02	9.84E+01	6.78E+01	5.05E+01	4.09E+01	3.32E+01	3.05E+01
76	1.37E+02	8.57E+01	5.95E+01	4.49E+01	3.63E+01	3.07E+01	2.85E+01
77	1.31E+02	8.01E+01	5.45E+01	4.05E+01	3.23E+01	2.70E+01	2.50E+01
78	1.45E+02	9.01E+01	6.20E+01	4.64E+01	3.71E+01	3.11E+01	2.87E+01
79	1.40E+02	8.96E+01	6.26E+01	4.69E+01	3.72E+01	3.07E+01	2.81E+01
80	1.71E+01	1.12E+01	8.21E+00	6.55E+00	5.55E+00	4.90E+00	4.64E+00
81	3.82E+00	1.70E+00	8.01E-01	4.18E-01	2.50E-01	1.74E-01	1.50E-01
82	4.46E+01	2.78E+01	1.90E+01	1.41E+01	1.12E+01	9.29E+00	8.54E+00
83	5.80E+01	3.45E+01	2.28E+01	1.65E+01	1.29E+01	1.06E+01	9.75E+00
84	5.75E+01	3.46E+01	2.31E+01	1.68E+01	1.32E+01	1.09E+01	9.98E+00
85	5.95E+01	3.45E+01	2.21E+01	1.54E+01	1.16E+01	9.25E+00	8.34E+00
86	6.64E+01	3.97E+01	2.61E+01	1.86E+01	1.43E+01	1.15E+01	1.05E+01
87	5.45E+01	3.41E+01	2.37E+01	1.79E+01	1.45E+01	1.23E+01	1.14E+01
88	7.63E+00	5.50E+00	4.29E+00	3.54E+00	3.05E+00	2.71E+00	2.57E+00
89	2.00E+00	8.88E-01	4.11E-01	2.01E-01	1.06E-01	6.06E-02	4.62E-02
90	1.72E+01	9.83E+00	6.26E+00	4.41E+00	3.39E+00	2.77E+00	2.54E+00
91	2.70E+01	1.52E+01	9.68E+00	6.87E+00	5.36E+00	4.45E+00	4.11E+00
92	2.46E+01	1.46E+01	9.77E+00	7.33E+00	5.98E+00	5.16E+00	4.85E+00
93	2.42E+01	1.31E+01	7.93E+00	5.32E+00	3.93E+00	3.12E+00	2.82E+00
94	3.41E+01	2.11E+01	1.43E+01	1.06E+01	8.31E+00	6.87E+00	6.30E+00
95	2.44E+01	1.51E+01	1.05E+01	8.12E+00	6.74E+00	5.87E+00	5.53E+00
96	2.31E+00	1.57E+00	1.17E+00	9.42E-01	8.01E-01	7.07E-01	6.69E-01
97	6.48E-01	2.66E-01	1.09E-01	4.49E-02	1.85E-02	7.59E-03	4.68E-03
98	2.78E+00	1.54E+00	9.35E-01	6.25E-01	4.54E-01	3.52E-01	3.14E-01
99	5.85E+00	3.00E+00	1.73E+00	1.13E+00	8.37E-01	6.76E-01	6.20E-01
100	5.67E+00	2.61E+00	1.31E+00	7.41E-01	4.87E-01	3.65E-01	3.26E-01
101	4.59E+00	2.30E+00	1.27E+00	7.90E-01	5.47E-01	4.15E-01	3.68E-01
102	5.65E+00	2.87E+00	1.58E+00	9.52E-01	6.32E-01	4.57E-01	3.95E-01
103	5.51E+00	3.21E+00	2.09E+00	1.52E+00	1.22E+00	1.04E+00	9.70E-01
104	1.26E+00	7.82E-01	5.32E-01	3.89E-01	3.02E-01	2.45E-01	2.23E-01

TABLE A2. The calculated absorbed dose rate (rad/h to GRANITE) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be filled with WATER.

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
1	4.59E+04	3.25E+04	2.45E+04	1.95E+04	1.62E+04	1.39E+04	1.30E+04
2	5.49E+04	3.90E+04	2.96E+04	2.38E+04	1.99E+04	1.72E+04	1.61E+04
3	5.65E+04	4.02E+04	3.06E+04	2.45E+04	2.05E+04	1.77E+04	1.65E+04
4	5.72E+04	4.07E+04	3.09E+04	2.48E+04	2.08E+04	1.80E+04	1.69E+04
5	5.76E+04	4.12E+04	3.14E+04	2.53E+04	2.13E+04	1.84E+04	1.73E+04
6	4.67E+04	3.30E+04	2.50E+04	2.00E+04	1.67E+04	1.44E+04	1.34E+04
7	1.58E+04	1.11E+04	8.30E+03	6.58E+03	5.46E+03	4.68E+03	4.36E+03
8	2.01E+04	1.42E+04	1.07E+04	8.59E+03	7.18E+03	6.20E+03	5.80E+03
9	2.05E+04	1.45E+04	1.10E+04	8.79E+03	7.35E+03	6.35E+03	5.94E+03
10	2.06E+04	1.46E+04	1.10E+04	8.77E+03	7.31E+03	6.29E+03	5.88E+03
11	2.01E+04	1.41E+04	1.07E+04	8.50E+03	7.09E+03	6.11E+03	5.71E+03
12	8.34E+03	5.79E+03	4.61E+03	4.05E+03	3.75E+03	3.57E+03	3.50E+03
13	7.76E+03	5.89E+03	4.63E+03	3.77E+03	3.17E+03	2.74E+03	2.55E+03
14	1.22E+04	8.65E+03	6.57E+03	5.28E+03	4.44E+03	3.85E+03	3.61E+03
15	1.29E+04	9.12E+03	6.89E+03	5.51E+03	4.60E+03	3.97E+03	3.71E+03
16	1.24E+04	8.81E+03	6.69E+03	5.37E+03	4.50E+03	3.90E+03	3.65E+03
17	1.23E+04	8.62E+03	6.46E+03	5.12E+03	4.24E+03	3.64E+03	3.39E+03
18	1.02E+04	7.14E+03	5.38E+03	4.29E+03	3.58E+03	3.09E+03	2.89E+03
19	2.26E+03	1.52E+03	1.18E+03	1.02E+03	9.41E+02	8.93E+02	8.74E+02
20	6.17E+03	4.31E+03	3.23E+03	2.57E+03	2.14E+03	1.85E+03	1.73E+03
21	6.69E+03	4.70E+03	3.53E+03	2.80E+03	2.31E+03	1.98E+03	1.84E+03
22	6.43E+03	4.49E+03	3.37E+03	2.67E+03	2.21E+03	1.90E+03	1.77E+03
23	6.48E+03	4.55E+03	3.42E+03	2.71E+03	2.25E+03	1.93E+03	1.80E+03
24	5.33E+03	3.73E+03	2.80E+03	2.23E+03	1.85E+03	1.59E+03	1.48E+03
25	2.08E+02	1.38E+02	9.96E+01	7.62E+01	6.14E+01	5.14E+01	4.73E+01
26	2.97E+03	2.07E+03	1.55E+03	1.24E+03	1.03E+03	8.94E+02	8.37E+02
27	3.84E+03	2.65E+03	1.97E+03	1.56E+03	1.30E+03	1.12E+03	1.04E+03
28	4.16E+03	2.91E+03	2.18E+03	1.73E+03	1.44E+03	1.24E+03	1.16E+03
29	4.09E+03	2.84E+03	2.12E+03	1.68E+03	1.39E+03	1.19E+03	1.11E+03
30	4.22E+03	2.92E+03	2.17E+03	1.70E+03	1.40E+03	1.19E+03	1.11E+03
31	3.40E+03	2.38E+03	1.79E+03	1.42E+03	1.19E+03	1.02E+03	9.58E+02
32	2.43E+02	1.68E+02	1.26E+02	1.01E+02	8.46E+01	7.37E+01	6.92E+01
33	1.47E+02	9.92E+01	7.23E+01	5.59E+01	4.55E+01	3.83E+01	3.54E+01
34	1.08E+03	7.17E+02	5.47E+02	4.61E+02	4.15E+02	3.87E+02	3.76E+02
35	2.69E+03	1.87E+03	1.41E+03	1.13E+03	9.53E+02	8.30E+02	7.79E+02

TABLE A2. (Continued.)

RAD PER HOUR							
DETECTOR NO.	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	2.63E+03	1.82E+03	1.36E+03	1.08E+03	9.01E+02	7.80E+02	7.30E+02
37	2.69E+03	1.87E+03	1.39E+03	1.10E+03	9.13E+02	7.84E+02	7.31E+02
38	2.20E+03	1.67E+03	1.32E+03	1.07E+03	9.02E+02	7.78E+02	7.26E+02
39	2.38E+03	1.65E+03	1.22E+03	9.57E+02	7.85E+02	6.66E+02	6.18E+02
40	1.64E+02	1.12E+02	8.34E+01	6.58E+01	5.46E+01	4.69E+01	4.38E+01
41	1.26E+02	8.44E+01	5.92E+01	4.32E+01	3.16E+01	2.53E+01	2.23E+01
42	1.29E+03	8.71E+02	6.34E+02	4.91E+02	4.00E+02	3.38E+02	3.13E+02
43	1.75E+03	1.19E+03	8.66E+02	6.70E+02	5.45E+02	4.60E+02	4.25E+02
44	1.64E+03	1.13E+03	8.42E+02	6.70E+02	5.61E+02	4.86E+02	4.56E+02
45	1.77E+03	1.22E+03	9.05E+02	7.14E+02	5.91E+02	5.08E+02	4.74E+02
46	1.71E+03	1.17E+03	8.63E+02	6.78E+02	5.59E+02	4.78E+02	4.46E+02
47	1.53E+03	1.05E+03	7.78E+02	6.10E+02	5.02E+02	4.28E+02	3.98E+02
48	9.96E+01	6.68E+01	4.95E+01	3.97E+01	3.36E+01	2.96E+01	2.80E+01
49	4.41E+01	2.75E+01	1.89E+01	1.41E+01	1.12E+01	9.32E+00	8.58E+00
50	8.07E+02	5.45E+02	3.99E+02	3.12E+02	2.57E+02	2.20E+02	2.04E+02
51	1.02E+03	6.82E+02	4.97E+02	3.88E+02	3.20E+02	2.74E+02	2.56E+02
52	1.10E+03	7.35E+02	5.35E+02	4.17E+02	3.42E+02	2.91E+02	2.71E+02
53	1.14E+03	7.65E+02	5.58E+02	4.34E+02	3.55E+02	3.02E+02	2.81E+02
54	1.14E+03	7.68E+02	5.58E+02	4.30E+02	3.49E+02	2.94E+02	2.72E+02
55	9.87E+02	6.66E+02	4.84E+02	3.73E+02	3.03E+02	2.54E+02	2.35E+02
56	2.42E+02	2.14E+02	1.97E+02	1.87E+02	1.80E+02	1.74E+02	1.71E+02
57	2.19E+01	1.39E+01	1.01E+01	8.17E+00	7.08E+00	6.41E+00	6.14E+00
58	3.18E+02	2.09E+02	1.50E+02	1.16E+02	9.55E+01	8.17E+01	7.62E+01
59	4.88E+02	3.17E+02	2.27E+02	1.75E+02	1.43E+02	1.22E+02	1.14E+02
60	4.76E+02	3.16E+02	2.31E+02	1.82E+02	1.52E+02	1.32E+02	1.24E+02
61	4.94E+02	3.24E+02	2.31E+02	1.76E+02	1.42E+02	1.19E+02	1.10E+02
62	4.96E+02	3.25E+02	2.32E+02	1.77E+02	1.43E+02	1.20E+02	1.11E+02
63	4.15E+02	2.81E+02	2.06E+02	1.61E+02	1.33E+02	1.13E+02	1.05E+02
64	1.83E+02	8.25E+01	4.00E+01	2.16E+01	1.35E+01	9.71E+00	8.53E+00
65	1.51E+01	1.08E+01	8.51E+00	7.23E+00	6.44E+00	5.90E+00	5.67E+00
66	1.60E+02	1.03E+02	7.38E+01	5.76E+01	4.78E+01	4.14E+01	3.89E+01
67	1.99E+02	1.22E+02	8.41E+01	6.35E+01	5.15E+01	4.39E+01	4.10E+01
68	1.84E+02	1.17E+02	8.19E+01	6.24E+01	5.07E+01	4.31E+01	4.01E+01
69	1.86E+02	1.19E+02	8.27E+01	6.21E+01	4.95E+01	4.13E+01	3.80E+01
70	1.17E+02	6.67E+01	4.50E+01	3.54E+01	3.09E+01	2.85E+01	2.77E+01

TABLE A2. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
71	2.16E+02	1.44E+02	1.03E+02	7.84E+01	6.27E+01	5.20E+01	4.77E+01
72	1.49E+01	9.36E+00	6.55E+00	5.03E+00	4.13E+00	3.55E+00	3.32E+00
73	3.19E+00	1.78E+00	1.10E+00	7.53E-01	5.62E-01	4.46E-01	4.03E-01
74	6.59E+01	4.03E+01	2.73E+01	2.03E+01	1.61E+01	1.35E+01	1.25E+01
75	7.12E+01	3.98E+01	2.52E+01	1.79E+01	1.41E+01	1.18E+01	1.10E+01
76	8.46E+01	5.06E+01	3.39E+01	2.50E+01	1.99E+01	1.68E+01	1.56E+01
77	7.37E+01	4.47E+01	3.01E+01	2.24E+01	1.79E+01	1.51E+01	1.40E+01
78	9.70E+01	5.97E+01	4.03E+01	2.93E+01	2.27E+01	1.85E+01	1.68E+01
79	8.73E+01	5.56E+01	3.90E+01	2.97E+01	2.41E+01	2.05E+01	1.90E+01
80	5.64E+00	3.50E+00	2.44E+00	1.86E+00	1.52E+00	1.30E+00	1.21E+00
81	2.59E+00	1.42E+00	8.37E-01	5.29E-01	3.54E-01	2.46E-01	2.05E-01
82	2.44E+01	1.42E+01	9.25E+00	6.67E+00	5.23E+00	4.35E+00	4.01E+00
83	3.46E+01	1.84E+01	1.11E+01	7.60E+00	5.81E+00	4.82E+00	4.46E+00
84	4.00E+01	2.34E+01	1.55E+01	1.14E+01	9.19E+00	7.84E+00	7.33E+00
85	3.28E+01	1.85E+01	1.17E+01	8.21E+00	6.33E+00	5.21E+00	4.79E+00
86	3.54E+01	2.02E+01	1.27E+01	8.85E+00	6.66E+00	5.34E+00	4.84E+00
87	3.40E+01	2.04E+01	1.36E+01	1.01E+01	8.01E+00	6.74E+00	6.24E+00
88	3.85E+00	2.65E+00	2.05E+00	1.71E+00	1.51E+00	1.38E+00	1.32E+00
89	5.42E-01	2.23E-01	9.20E-02	3.78E-02	1.56E-02	6.44E-03	3.97E-03
90	1.11E+01	6.03E+00	3.58E+00	2.31E+00	1.61E+00	1.18E+00	1.02E+00
91	1.68E+01	8.37E+00	4.65E+00	2.96E+00	2.15E+00	1.72E+00	1.58E+00
92	2.21E+01	1.20E+01	7.35E+00	5.02E+00	3.78E+00	3.06E+00	2.79E+00
93	1.36E+01	7.32E+00	4.42E+00	3.02E+00	2.30E+00	1.89E+00	1.75E+00
94	1.94E+01	1.06E+01	6.32E+00	4.11E+00	2.90E+00	2.18E+00	1.91E+00
95	1.75E+01	1.05E+01	7.05E+00	5.22E+00	4.18E+00	3.54E+00	3.29E+00
96	3.45E+00	2.55E+00	2.06E+00	1.77E+00	1.58E+00	1.45E+00	1.39E+00
97	4.30E-02	2.62E-02	1.91E-02	1.60E-02	1.45E-02	1.37E-02	1.34E-02
98	2.71E+00	1.43E+00	8.17E-01	5.01E-01	3.28E-01	2.25E-01	1.87E-01
99	4.15E+00	1.79E+00	8.09E-01	4.00E-01	2.28E-01	1.55E-01	1.34E-01
100	5.10E+00	2.36E+00	1.18E+00	6.54E-01	4.13E-01	2.94E-01	2.55E-01
101	2.36E+00	1.21E+00	6.87E-01	4.39E-01	3.13E-01	2.44E-01	2.20E-01
102	2.49E+00	1.23E+00	6.44E-01	3.62E-01	2.18E-01	1.39E-01	1.12E-01
103	3.72E+00	1.91E+00	1.10E+00	7.19E-01	5.30E-01	4.27E-01	3.91E-01
104	8.95E-01	5.92E-01	4.63E-01	4.05E-01	3.76E-01	3.60E-01	3.53E-01

TABLE A3. The calculated absorbed dose rate (rad/h to GRANITE) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be filled with COMPACTED BENTONITE.

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
1	4.55E+04	3.23E+04	2.45E+04	1.95E+04	1.63E+04	1.40E+04	1.31E+04
2	5.49E+04	3.91E+04	2.97E+04	2.38E+04	1.99E+04	1.72E+04	1.61E+04
3	5.61E+04	3.99E+04	3.04E+04	2.43E+04	2.04E+04	1.76E+04	1.64E+04
4	5.90E+04	4.19E+04	3.18E+04	2.55E+04	2.14E+04	1.85E+04	1.74E+04
5	5.82E+04	4.14E+04	3.14E+04	2.52E+04	2.10E+04	1.82E+04	1.70E+04
6	4.64E+04	3.29E+04	2.49E+04	1.99E+04	1.66E+04	1.44E+04	1.34E+04
7	1.60E+04	1.12E+04	8.42E+03	6.69E+03	5.55E+03	4.77E+03	4.45E+03
8	2.03E+04	1.43E+04	1.08E+04	8.65E+03	7.22E+03	6.23E+03	5.82E+03
9	2.06E+04	1.46E+04	1.10E+04	8.82E+03	7.36E+03	6.36E+03	5.94E+03
10	2.11E+04	1.49E+04	1.12E+04	8.92E+03	7.41E+03	6.37E+03	5.94E+03
11	2.05E+04	1.44E+04	1.09E+04	8.64E+03	7.19E+03	6.19E+03	5.78E+03
12	1.71E+04	1.20E+04	9.10E+03	7.26E+03	6.06E+03	5.23E+03	4.89E+03
13	9.69E+03	6.77E+03	5.06E+03	4.00E+03	3.30E+03	2.82E+03	2.63E+03
14	1.24E+04	8.71E+03	6.58E+03	5.25E+03	4.39E+03	3.80E+03	3.56E+03
15	1.30E+04	9.19E+03	6.95E+03	5.54E+03	4.62E+03	3.98E+03	3.72E+03
16	1.29E+04	9.12E+03	6.87E+03	5.46E+03	4.54E+03	3.90E+03	3.64E+03
17	1.27E+04	8.92E+03	6.70E+03	5.32E+03	4.41E+03	3.79E+03	3.53E+03
18	1.05E+04	7.32E+03	5.49E+03	4.35E+03	3.61E+03	3.10E+03	2.90E+03
19	3.14E+03	2.19E+03	1.64E+03	1.30E+03	1.08E+03	9.27E+02	8.65E+02
20	4.14E+03	2.91E+03	2.20E+03	1.76E+03	1.47E+03	1.28E+03	1.20E+03
21	4.30E+03	2.98E+03	2.22E+03	1.75E+03	1.44E+03	1.23E+03	1.15E+03
22	4.28E+03	2.97E+03	2.22E+03	1.75E+03	1.45E+03	1.24E+03	1.16E+03
23	4.27E+03	2.96E+03	2.21E+03	1.75E+03	1.45E+03	1.25E+03	1.17E+03
24	3.45E+03	2.38E+03	1.77E+03	1.40E+03	1.16E+03	9.93E+02	9.26E+02
25	1.11E+02	7.95E+01	6.32E+01	5.39E+01	4.81E+01	4.42E+01	4.26E+01
26	2.09E+03	1.43E+03	1.05E+03	8.20E+02	6.70E+02	5.67E+02	5.25E+02
27	2.66E+03	1.82E+03	1.35E+03	1.06E+03	8.72E+02	7.45E+02	6.93E+02
28	2.75E+03	1.90E+03	1.41E+03	1.12E+03	9.26E+02	7.95E+02	7.42E+02
29	2.75E+03	1.90E+03	1.42E+03	1.12E+03	9.27E+02	7.95E+02	7.42E+02
30	2.75E+03	1.90E+03	1.41E+03	1.11E+03	9.22E+02	7.91E+02	7.37E+02
31	2.29E+03	1.57E+03	1.16E+03	9.12E+02	7.53E+02	6.45E+02	6.01E+02
32	1.21E+02	8.17E+01	6.07E+01	4.83E+01	4.05E+01	3.53E+01	3.31E+01
33	6.91E+01	4.39E+01	3.01E+01	2.19E+01	1.69E+01	1.35E+01	1.22E+01
34	1.29E+03	8.78E+02	6.41E+02	4.97E+02	4.03E+02	3.40E+02	3.14E+02
35	1.58E+03	1.07E+03	7.87E+02	6.17E+02	5.10E+02	4.38E+02	4.09E+02

TABLE A3. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	1.68E+03	1.14E+03	8.35E+02	6.52E+02	5.36E+02	4.57E+02	4.25E+02
37	1.80E+03	1.23E+03	9.03E+02	7.07E+02	5.82E+02	4.97E+02	4.62E+02
38	1.78E+03	1.22E+03	9.09E+02	7.17E+02	5.94E+02	5.10E+02	4.76E+02
39	1.48E+03	1.00E+03	7.38E+02	5.79E+02	4.77E+02	4.08E+02	3.80E+02
40	7.80E+01	5.19E+01	3.83E+01	3.06E+01	2.58E+01	2.27E+01	2.14E+01
41	3.66E+01	2.33E+01	1.64E+01	1.25E+01	1.02E+01	8.66E+00	8.06E+00
42	8.20E+02	5.38E+02	3.84E+02	2.94E+02	2.38E+02	2.00E+02	1.85E+02
43	1.02E+03	6.87E+02	5.02E+02	3.92E+02	3.23E+02	2.76E+02	2.57E+02
44	1.05E+03	7.03E+02	5.11E+02	3.98E+02	3.27E+02	2.79E+02	2.60E+02
45	1.19E+03	8.06E+02	5.92E+02	4.63E+02	3.81E+02	3.25E+02	3.03E+02
46	1.17E+03	7.87E+02	5.73E+02	4.43E+02	3.61E+02	3.05E+02	2.82E+02
47	9.86E+02	6.64E+02	4.83E+02	3.74E+02	3.05E+02	2.58E+02	2.39E+02
48	5.82E+01	3.83E+01	2.76E+01	2.13E+01	1.75E+01	1.49E+01	1.38E+01
49	3.73E+01	2.16E+01	1.43E+01	1.06E+01	8.61E+00	7.42E+00	6.97E+00
50	5.14E+02	3.40E+02	2.45E+02	1.90E+02	1.56E+02	1.33E+02	1.24E+02
51	7.06E+02	4.66E+02	3.35E+02	2.57E+02	2.09E+02	1.76E+02	1.63E+02
52	6.85E+02	4.58E+02	3.34E+02	2.61E+02	2.15E+02	1.85E+02	1.72E+02
53	7.56E+02	5.05E+02	3.66E+02	2.83E+02	2.30E+02	1.94E+02	1.80E+02
54	7.67E+02	5.13E+02	3.71E+02	2.87E+02	2.33E+02	1.96E+02	1.82E+02
55	6.29E+02	4.19E+02	3.03E+02	2.34E+02	1.90E+02	1.61E+02	1.49E+02
56	3.35E+01	2.23E+01	1.64E+01	1.31E+01	1.11E+01	9.72E+00	9.18E+00
57	2.60E+01	1.75E+01	1.26E+01	9.59E+00	7.60E+00	6.24E+00	5.69E+00
58	2.43E+02	1.56E+02	1.10E+02	8.47E+01	6.92E+01	5.91E+01	5.50E+01
59	2.96E+02	1.90E+02	1.33E+02	1.01E+02	8.14E+01	6.85E+01	6.33E+01
60	2.82E+02	1.82E+02	1.29E+02	9.95E+01	8.14E+01	6.95E+01	6.47E+01
61	2.85E+02	1.82E+02	1.27E+02	9.60E+01	7.71E+01	6.48E+01	5.99E+01
62	3.01E+02	1.97E+02	1.41E+02	1.08E+02	8.80E+01	7.44E+01	6.90E+01
63	3.22E+02	2.17E+02	1.61E+02	1.29E+02	1.09E+02	9.55E+01	9.01E+01
64	1.74E+01	1.15E+01	8.31E+00	6.51E+00	5.40E+00	4.66E+00	4.37E+00
65	5.55E+00	3.43E+00	2.43E+00	1.92E+00	1.64E+00	1.47E+00	1.40E+00
66	9.73E+01	5.75E+01	3.78E+01	2.75E+01	2.16E+01	1.79E+01	1.65E+01
67	1.22E+02	7.42E+01	4.97E+01	3.63E+01	2.85E+01	2.35E+01	2.16E+01
68	1.21E+02	7.41E+01	5.02E+01	3.70E+01	2.92E+01	2.42E+01	2.22E+01
69	1.20E+02	7.45E+01	5.14E+01	3.86E+01	3.10E+01	2.61E+01	2.42E+01
70	1.35E+02	8.66E+01	6.10E+01	4.65E+01	3.76E+01	3.19E+01	2.96E+01

TABLE A3. (Continued.)

RAD PER HOUR							
DETECTOR NO.	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
71	1.20E+02	7.56E+01	5.28E+01	4.02E+01	3.28E+01	2.80E+01	2.62E+01
72	1.05E+01	6.74E+00	4.75E+00	3.59E+00	2.87E+00	2.39E+00	2.20E+00
73	3.06E+00	1.58E+00	9.41E-01	6.51E-01	5.13E-01	4.42E-01	4.17E-01
74	4.26E+01	2.51E+01	1.64E+01	1.18E+01	9.15E+00	7.53E+00	6.90E+00
75	5.28E+01	2.99E+01	1.87E+01	1.29E+01	9.69E+00	7.74E+00	7.00E+00
76	5.46E+01	3.20E+01	2.10E+01	1.53E+01	1.21E+01	1.02E+01	9.45E+00
77	5.36E+01	3.20E+01	2.12E+01	1.54E+01	1.21E+01	1.00E+01	9.19E+00
78	6.97E+01	4.41E+01	3.04E+01	2.24E+01	1.75E+01	1.43E+01	1.30E+01
79	4.57E+01	2.72E+01	1.84E+01	1.39E+01	1.15E+01	1.00E+01	9.45E+00
80	4.40E+00	2.58E+00	1.67E+00	1.18E+00	9.00E-01	7.22E-01	6.53E-01
81	1.01E+00	4.32E-01	1.90E-01	8.74E-02	4.41E-02	2.55E-02	2.03E-02
82	1.75E+01	9.23E+00	5.42E+00	3.56E+00	2.58E+00	2.03E+00	1.83E+00
83	2.50E+01	1.37E+01	8.38E+00	5.73E+00	4.30E+00	3.46E+00	3.15E+00
84	2.32E+01	1.30E+01	8.12E+00	5.66E+00	4.32E+00	3.53E+00	3.23E+00
85	2.30E+01	1.33E+01	8.68E+00	6.31E+00	5.00E+00	4.20E+00	3.90E+00
86	2.85E+01	1.70E+01	1.11E+01	7.92E+00	6.01E+00	4.81E+00	4.34E+00
87	2.31E+01	1.32E+01	8.66E+00	6.39E+00	5.19E+00	4.49E+00	4.22E+00
88	3.10E+00	1.62E+00	9.40E-01	6.00E-01	4.19E-01	3.15E-01	2.76E-01
89	2.90E-01	1.19E-01	4.90E-02	2.01E-02	8.29E-03	3.42E-03	2.12E-03
90	8.02E+00	4.20E+00	2.41E+00	1.52E+00	1.05E+00	7.80E-01	6.80E-01
91	1.22E+01	6.03E+00	3.30E+00	2.05E+00	1.44E+00	1.13E+00	1.02E+00
92	1.14E+01	6.38E+00	4.04E+00	2.86E+00	2.23E+00	1.85E+00	1.71E+00
93	1.03E+01	5.67E+00	3.49E+00	2.38E+00	1.78E+00	1.42E+00	1.29E+00
94	2.15E+01	1.33E+01	8.74E+00	6.03E+00	4.32E+00	3.18E+00	2.73E+00
95	1.23E+01	7.40E+00	4.99E+00	3.72E+00	2.99E+00	2.54E+00	2.36E+00
96	1.71E+00	9.34E-01	5.68E-01	3.83E-01	2.82E-01	2.22E-01	1.99E-01
97	4.40E-05	2.18E-05	1.25E-05	8.63E-06	6.99E-06	6.08E-06	5.84E-06
98	9.91E-01	5.05E-01	2.98E-01	2.06E-01	1.65E-01	1.45E-01	1.38E-01
99	2.40E+00	1.01E+00	4.36E-01	1.92E-01	8.88E-02	4.34E-02	3.02E-02
100	2.96E+00	1.45E+00	7.83E-01	4.70E-01	3.14E-01	2.30E-01	2.01E-01
101	2.48E+00	1.22E+00	6.46E-01	3.72E-01	2.33E-01	1.56E-01	1.28E-01
102	1.76E+00	8.93E-01	4.88E-01	2.89E-01	1.85E-01	1.26E-01	1.05E-01
103	3.10E+00	1.53E+00	8.40E-01	5.26E-01	3.76E-01	2.97E-01	2.69E-01
104	8.01E-01	5.84E-01	4.89E-01	4.44E-01	4.20E-01	4.05E-01	3.99E-01

**TABLE A4.** The calculated absorbed dose rate (rad/h to GRANITE) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
1	4.76E+04	3.37E+04	2.54E+04	2.01E+04	1.67E+04	1.43E+04	1.33E+04
2	5.44E+04	3.86E+04	2.93E+04	2.35E+04	1.97E+04	1.70E+04	1.59E+04
3	5.68E+04	4.04E+04	3.07E+04	2.46E+04	2.05E+04	1.77E+04	1.65E+04
4	5.75E+04	4.09E+04	3.12E+04	2.51E+04	2.11E+04	1.83E+04	1.72E+04
5	5.77E+04	4.11E+04	3.13E+04	2.51E+04	2.11E+04	1.83E+04	1.71E+04
6	4.80E+04	3.40E+04	2.57E+04	2.04E+04	1.70E+04	1.46E+04	1.37E+04
7	1.61E+04	1.13E+04	8.50E+03	6.75E+03	5.60E+03	4.81E+03	4.49E+03
8	2.03E+04	1.44E+04	1.09E+04	8.69E+03	7.26E+03	6.27E+03	5.86E+03
9	2.08E+04	1.47E+04	1.12E+04	8.91E+03	7.44E+03	6.41E+03	5.99E+03
10	2.01E+04	1.42E+04	1.07E+04	8.54E+03	7.12E+03	6.13E+03	5.73E+03
11	2.05E+04	1.45E+04	1.09E+04	8.73E+03	7.27E+03	6.26E+03	5.85E+03
12	1.74E+04	1.23E+04	9.24E+03	7.35E+03	6.11E+03	5.25E+03	4.90E+03
13	9.87E+03	6.91E+03	5.18E+03	4.09E+03	3.39E+03	2.90E+03	2.70E+03
14	1.28E+04	9.01E+03	6.80E+03	5.42E+03	4.52E+03	3.89E+03	3.63E+03
15	1.29E+04	9.09E+03	6.88E+03	5.50E+03	4.59E+03	3.97E+03	3.71E+03
16	1.24E+04	8.72E+03	6.57E+03	5.24E+03	4.36E+03	3.76E+03	3.51E+03
17	1.28E+04	8.99E+03	6.76E+03	5.37E+03	4.46E+03	3.83E+03	3.58E+03
18	1.03E+04	7.19E+03	5.42E+03	4.31E+03	3.59E+03	3.09E+03	2.89E+03
19	3.13E+03	2.17E+03	1.62E+03	1.27E+03	1.05E+03	8.93E+02	8.30E+02
20	4.01E+03	2.81E+03	2.11E+03	1.68E+03	1.40E+03	1.21E+03	1.13E+03
21	4.07E+03	2.83E+03	2.12E+03	1.68E+03	1.40E+03	1.20E+03	1.12E+03
22	4.00E+03	2.79E+03	2.10E+03	1.68E+03	1.40E+03	1.22E+03	1.14E+03
23	4.21E+03	2.92E+03	2.18E+03	1.72E+03	1.42E+03	1.22E+03	1.13E+03
24	3.57E+03	2.47E+03	1.84E+03	1.45E+03	1.19E+03	1.02E+03	9.44E+02
25	1.24E+02	8.22E+01	5.84E+01	4.40E+01	3.49E+01	2.87E+01	2.62E+01
26	2.00E+03	1.36E+03	1.00E+03	7.78E+02	6.36E+02	5.39E+02	5.00E+02
27	2.56E+03	1.77E+03	1.32E+03	1.04E+03	8.63E+02	7.41E+02	6.91E+02
28	2.74E+03	1.89E+03	1.40E+03	1.10E+03	9.10E+02	7.78E+02	7.24E+02
29	2.56E+03	1.76E+03	1.31E+03	1.04E+03	8.64E+02	7.44E+02	6.95E+02
30	2.60E+03	1.80E+03	1.34E+03	1.06E+03	8.84E+02	7.61E+02	7.11E+02
31	2.21E+03	1.52E+03	1.13E+03	8.88E+02	7.32E+02	6.25E+02	5.81E+02
32	1.43E+02	9.92E+01	7.46E+01	5.98E+01	5.04E+01	4.40E+01	4.14E+01
33	8.79E+01	5.83E+01	4.16E+01	3.16E+01	2.53E+01	2.10E+01	1.93E+01
34	1.30E+03	8.78E+02	6.38E+02	4.91E+02	3.97E+02	3.33E+02	3.07E+02
35	1.59E+03	1.09E+03	8.07E+02	6.36E+02	5.27E+02	4.52E+02	4.22E+02

TABLE A4. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	1.69E+03	1.15E+03	8.49E+02	6.67E+02	5.50E+02	4.71E+02	4.39E+02
37	1.65E+03	1.12E+03	8.30E+02	6.55E+02	5.43E+02	4.68E+02	4.37E+02
38	1.67E+03	1.14E+03	8.40E+02	6.58E+02	5.43E+02	4.64E+02	4.32E+02
39	1.34E+03	9.14E+02	6.75E+02	5.33E+02	4.42E+02	3.81E+02	3.56E+02
40	1.13E+02	7.73E+01	5.66E+01	4.38E+01	3.56E+01	2.99E+01	2.75E+01
41	6.03E+01	3.93E+01	2.76E+01	2.06E+01	1.62E+01	1.33E+01	1.21E+01
42	8.12E+02	5.41E+02	3.90E+02	2.99E+02	2.42E+02	2.04E+02	1.88E+02
43	1.03E+03	6.92E+02	5.06E+02	3.94E+02	3.24E+02	2.76E+02	2.57E+02
44	1.06E+03	7.18E+02	5.27E+02	4.13E+02	3.41E+02	2.92E+02	2.72E+02
45	1.03E+03	6.89E+02	5.01E+02	3.92E+02	3.24E+02	2.79E+02	2.61E+02
46	1.08E+03	7.27E+02	5.33E+02	4.17E+02	3.43E+02	2.93E+02	2.72E+02
47	8.45E+02	5.68E+02	4.16E+02	3.27E+02	2.70E+02	2.33E+02	2.17E+02
48	9.33E+01	6.50E+01	4.78E+01	3.68E+01	2.95E+01	2.44E+01	2.23E+01
49	4.31E+01	2.78E+01	1.94E+01	1.46E+01	1.16E+01	9.59E+00	8.80E+00
50	5.39E+02	3.54E+02	2.53E+02	1.95E+02	1.58E+02	1.34E+02	1.24E+02
51	6.79E+02	4.43E+02	3.16E+02	2.43E+02	1.97E+02	1.67E+02	1.55E+02
52	6.95E+02	4.64E+02	3.37E+02	2.62E+02	2.15E+02	1.83E+02	1.70E+02
53	6.61E+02	4.36E+02	3.14E+02	2.43E+02	1.98E+02	1.69E+02	1.57E+02
54	6.85E+02	4.56E+02	3.30E+02	2.55E+02	2.08E+02	1.76E+02	1.63E+02
55	5.65E+02	3.79E+02	2.77E+02	2.17E+02	1.80E+02	1.55E+02	1.45E+02
56	5.85E+01	4.11E+01	3.12E+01	2.51E+01	2.12E+01	1.85E+01	1.74E+01
57	1.92E+01	1.20E+01	8.23E+00	6.10E+00	4.82E+00	3.99E+00	3.66E+00
58	2.25E+02	1.44E+02	1.01E+02	7.67E+01	6.19E+01	5.22E+01	4.83E+01
59	3.42E+02	2.23E+02	1.59E+02	1.22E+02	9.95E+01	8.45E+01	7.85E+01
60	2.93E+02	1.88E+02	1.32E+02	9.99E+01	8.02E+01	6.72E+01	6.20E+01
61	2.83E+02	1.77E+02	1.22E+02	9.17E+01	7.36E+01	6.18E+01	5.72E+01
62	2.75E+02	1.79E+02	1.27E+02	9.67E+01	7.81E+01	6.57E+01	6.07E+01
63	2.50E+02	1.66E+02	1.22E+02	9.78E+01	8.32E+01	7.37E+01	6.98E+01
64	2.32E+01	1.50E+01	1.06E+01	8.01E+00	6.42E+00	5.37E+00	4.95E+00
65	1.12E+01	6.96E+00	4.62E+00	3.24E+00	2.38E+00	1.81E+00	1.58E+00
66	1.15E+02	7.10E+01	4.79E+01	3.48E+01	2.70E+01	2.19E+01	1.99E+01
67	1.37E+02	8.59E+01	5.91E+01	4.40E+01	3.49E+01	2.90E+01	2.66E+01
68	1.25E+02	7.75E+01	5.30E+01	3.92E+01	3.09E+01	2.56E+01	2.35E+01
69	1.29E+02	7.98E+01	5.44E+01	4.04E+01	3.20E+01	2.66E+01	2.45E+01
70	1.36E+02	8.76E+01	6.19E+01	4.71E+01	3.81E+01	3.21E+01	2.97E+01

TABLE A4. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
71	1.01E+02	6.40E+01	4.56E+01	3.57E+01	2.99E+01	2.62E+01	2.48E+01
72	8.61E+00	5.24E+00	3.64E+00	2.83E+00	2.38E+00	2.11E+00	2.00E+00
73	6.63E+00	3.84E+00	2.40E+00	1.60E+00	1.12E+00	8.11E-01	6.91E-01
74	4.90E+01	2.92E+01	1.94E+01	1.40E+01	1.10E+01	9.04E+00	8.29E+00
75	5.53E+01	3.27E+01	2.15E+01	1.56E+01	1.22E+01	1.01E+01	9.29E+00
76	5.09E+01	3.03E+01	2.01E+01	1.47E+01	1.16E+01	9.73E+00	8.99E+00
77	5.05E+01	2.99E+01	1.97E+01	1.44E+01	1.14E+01	9.53E+00	8.82E+00
78	6.18E+01	3.92E+01	2.71E+01	2.02E+01	1.59E+01	1.30E+01	1.19E+01
79	4.28E+01	2.64E+01	1.89E+01	1.50E+01	1.28E+01	1.14E+01	1.08E+01
80	3.70E+00	1.93E+00	1.15E+00	7.91E-01	6.18E-01	5.26E-01	4.94E-01
81	3.19E+00	1.66E+00	9.40E-01	5.78E-01	3.83E-01	2.68E-01	2.26E-01
82	2.25E+01	1.22E+01	7.27E+00	4.70E+00	3.27E+00	2.41E+00	2.09E+00
83	3.16E+01	1.79E+01	1.12E+01	7.66E+00	5.70E+00	4.50E+00	4.05E+00
84	2.36E+01	1.34E+01	8.52E+00	5.99E+00	4.60E+00	3.76E+00	3.44E+00
85	2.22E+01	1.22E+01	7.69E+00	5.51E+00	4.39E+00	3.75E+00	3.52E+00
86	2.31E+01	1.35E+01	8.80E+00	6.33E+00	4.93E+00	4.06E+00	3.73E+00
87	1.91E+01	1.16E+01	8.00E+00	6.11E+00	5.05E+00	4.39E+00	4.13E+00
88	2.57E+00	1.16E+00	5.75E-01	3.25E-01	2.17E-01	1.67E-01	1.52E-01
89	3.06E+00	1.93E+00	1.28E+00	8.71E-01	6.05E-01	4.24E-01	3.51E-01
90	7.02E+00	3.36E+00	1.78E+00	1.07E+00	7.45E-01	5.81E-01	5.27E-01
91	1.36E+01	7.29E+00	4.39E+00	2.96E+00	2.21E+00	1.77E+00	1.61E+00
92	1.28E+01	6.86E+00	4.15E+00	2.83E+00	2.14E+00	1.75E+00	1.61E+00
93	8.63E+00	4.07E+00	2.13E+00	1.28E+00	9.06E-01	7.27E-01	6.70E-01
94	1.38E+01	8.08E+00	5.18E+00	3.59E+00	2.66E+00	2.06E+00	1.84E+00
95	8.41E+00	5.43E+00	4.05E+00	3.36E+00	2.99E+00	2.76E+00	2.66E+00
96	1.48E+00	7.28E-01	4.12E-01	2.76E-01	2.17E-01	1.88E-01	1.79E-01
97	1.87E-01	1.23E-01	8.31E-02	5.75E-02	4.04E-02	2.85E-02	2.36E-02
98	1.59E+00	7.25E-01	3.64E-01	2.11E-01	1.45E-01	1.15E-01	1.06E-01
99	2.94E+00	1.39E+00	7.21E-01	4.21E-01	2.00E-01	2.09E-01	1.86E-01
100	4.06E+00	1.98E+00	1.06E+00	6.31E-01	4.25E-01	3.17E-01	2.80E-01
101	2.21E+00	9.12E-01	3.78E-01	1.58E-01	0.69E-02	2.90E-02	1.88E-02
102	1.72E+00	1.02E+00	6.83E-01	5.03E-01	4.00E-01	3.36E-01	3.11E-01
103	1.30E+00	5.87E-01	2.88E-01	1.43E-01	8.02E-02	4.92E-02	3.91E-02
104	7.92E-01	5.80E-01	4.87E-01	4.43E-01	4.20E-01	4.05E-01	3.98E-01

TABLE A5. The calculated absorbed dose rate (rad/h to LiF) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be VOID.

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
1	4.17E+04	2.95E+04	2.23E+04	1.78E+04	1.49E+04	1.28E+04	1.19E+04
2	5.09E+04	3.61E+04	2.74E+04	2.18E+04	1.82E+04	1.57E+04	1.46E+04
3	5.25E+04	3.74E+04	2.85E+04	2.28E+04	1.91E+04	1.65E+04	1.54E+04
4	5.46E+04	3.87E+04	2.92E+04	2.33E+04	1.94E+04	1.67E+04	1.56E+04
5	5.31E+04	3.80E+04	2.90E+04	2.33E+04	1.96E+04	1.69E+04	1.59E+04
6	4.33E+04	3.06E+04	2.32E+04	1.85E+04	1.55E+04	1.33E+04	1.25E+04
7	1.52E+04	1.07E+04	8.01E+03	6.33E+03	5.23E+03	4.46E+03	4.15E+03
8	1.86E+04	1.32E+04	9.98E+03	7.97E+03	6.66E+03	5.75E+03	5.37E+03
9	1.89E+04	1.34E+04	1.01E+04	8.11E+03	6.77E+03	5.85E+03	5.47E+03
10	1.90E+04	1.33E+04	1.00E+04	7.97E+03	6.62E+03	5.69E+03	5.31E+03
11	1.89E+04	1.33E+04	1.00E+04	7.99E+03	6.66E+03	5.73E+03	5.35E+03
12	1.57E+04	1.11E+04	8.34E+03	6.65E+03	5.55E+03	4.79E+03	4.47E+03
13	8.57E+03	6.01E+03	4.50E+03	3.56E+03	2.95E+03	2.53E+03	2.35E+03
14	1.08E+04	7.59E+03	5.72E+03	4.57E+03	3.82E+03	3.30E+03	3.08E+03
15	1.12E+04	7.89E+03	5.96E+03	4.76E+03	3.97E+03	3.43E+03	3.21E+03
16	1.10E+04	7.74E+03	5.81E+03	4.62E+03	3.84E+03	3.30E+03	3.08E+03
17	1.10E+04	7.76E+03	5.84E+03	4.64E+03	3.85E+03	3.31E+03	3.09E+03
18	9.22E+03	6.46E+03	4.86E+03	3.86E+03	3.21E+03	2.77E+03	2.58E+03
19	6.36E+03	4.46E+03	3.34E+03	2.65E+03	2.20E+03	1.88E+03	1.76E+03
20	8.56E+03	6.06E+03	4.60E+03	3.68E+03	3.08E+03	2.66E+03	2.49E+03
21	8.76E+03	6.15E+03	4.63E+03	3.68E+03	3.06E+03	2.63E+03	2.46E+03
22	8.60E+03	6.05E+03	4.57E+03	3.64E+03	3.04E+03	2.62E+03	2.45E+03
23	8.73E+03	6.13E+03	4.60E+03	3.64E+03	3.02E+03	2.58E+03	2.41E+03
24	7.03E+03	4.95E+03	3.73E+03	2.97E+03	2.47E+03	2.12E+03	1.98E+03
25	3.54E+02	2.44E+02	1.81E+02	1.43E+02	1.19E+02	1.02E+02	9.57E+01
26	4.24E+03	2.96E+03	2.22E+03	1.76E+03	1.46E+03	1.25E+03	1.16E+03
27	5.76E+03	4.03E+03	3.03E+03	2.41E+03	2.01E+03	1.74E+03	1.63E+03
28	6.20E+03	4.34E+03	3.26E+03	2.59E+03	2.15E+03	1.84E+03	1.72E+03
29	6.62E+03	4.68E+03	3.52E+03	2.88E+03	2.32E+03	1.99E+03	1.86E+03
30	5.96E+03	4.19E+03	3.16E+03	2.51E+03	2.09E+03	1.80E+03	1.68E+03
31	4.85E+03	3.40E+03	2.56E+03	2.04E+03	1.69E+03	1.46E+03	1.36E+03
32	4.28E+02	2.97E+02	2.23E+02	1.79E+02	1.51E+02	1.31E+02	1.24E+02
33	2.28E+02	1.53E+02	1.11E+02	8.71E+01	7.19E+01	6.18E+01	5.78E+01
34	2.89E+03	2.00E+03	1.49E+03	1.18E+03	9.72E+02	8.31E+02	7.74E+02
35	3.69E+03	2.56E+03	1.91E+03	1.51E+03	1.26E+03	1.08E+03	1.01E+03

TABLE A5. (Continued.)

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RAD PER HOUR							
DETECTOR NO.	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	3.95E+03	2.76E+03	2.08E+03	1.65E+03	1.38E+03	1.19E+03	1.11E+03
37	3.89E+03	2.70E+03	2.02E+03	1.60E+03	1.32E+03	1.14E+03	1.06E+03
38	3.90E+03	2.71E+03	2.02E+03	1.60E+03	1.32E+03	1.13E+03	1.05E+03
39	3.16E+03	2.18E+03	1.63E+03	1.29E+03	1.07E+03	9.25E+02	8.65E+02
40	2.65E+02	1.80E+02	1.33E+02	1.06E+02	8.83E+01	7.67E+01	7.20E+01
41	1.49E+02	1.02E+02	7.66E+01	5.12E+01	5.14E+01	4.47E+01	4.20E+01
42	1.83E+03	1.26E+03	9.32E+02	7.31E+02	6.02E+02	5.13E+02	4.77E+02
43	2.46E+03	1.70E+03	1.26E+03	9.91E+02	8.19E+02	7.01E+02	6.53E+02
44	2.61E+03	1.81E+03	1.35E+03	1.07E+03	8.86E+02	7.60E+02	7.08E+02
45	2.52E+03	1.73E+03	1.28E+03	1.01E+03	8.32E+02	7.11E+02	6.61E+02
46	2.64E+03	1.83E+03	1.35E+03	1.06E+03	8.76E+02	7.47E+02	6.94E+02
47	2.11E+03	1.45E+03	1.07E+03	8.46E+02	6.99E+02	5.98E+02	5.58E+02
48	1.83E+02	1.23E+02	9.10E+01	7.23E+01	6.07E+01	5.29E+01	4.97E+01
49	9.51E+01	6.07E+01	4.24E+01	3.20E+01	2.57E+01	2.15E+01	1.99E+01
50	1.25E+03	8.52E+02	6.25E+02	4.88E+02	3.99E+02	3.39E+02	3.15E+02
51	1.58E+03	1.08E+03	8.01E+02	6.32E+02	5.24E+02	4.51E+02	4.21E+02
52	1.71E+03	1.17E+03	8.62E+02	6.77E+02	5.58E+02	4.77E+02	4.44E+02
53	1.65E+03	1.13E+03	8.33E+02	6.54E+02	5.39E+02	4.61E+02	4.30E+02
54	1.72E+03	1.18E+03	8.72E+02	6.82E+02	5.59E+02	4.74E+02	4.40E+02
55	1.34E+03	8.99E+02	6.55E+02	5.10E+02	4.17E+02	3.55E+02	3.29E+02
56	1.21E+02	8.24E+01	6.17E+01	4.97E+01	4.22E+01	3.71E+01	3.50E+01
57	3.77E+01	2.42E+01	1.71E+01	1.31E+01	1.06E+01	9.00E+00	8.36E+00
58	5.14E+02	3.40E+02	2.44E+02	1.87E+02	1.51E+02	1.28E+02	1.18E+02
59	7.30E+02	4.88E+02	3.54E+02	2.74E+02	2.23E+02	1.89E+02	1.76E+02
60	6.89E+02	4.53E+02	3.24E+02	2.49E+02	2.02E+02	1.71E+02	1.59E+02
61	6.84E+02	4.53E+02	3.26E+02	2.50E+02	2.03E+02	1.71E+02	1.58E+02
62	7.40E+02	4.96E+02	3.60E+02	2.79E+02	2.27E+02	1.93E+02	1.79E+02
63	5.73E+02	3.81E+02	2.76E+02	2.14E+02	1.75E+02	1.49E+02	1.39E+02
64	6.12E+01	4.04E+01	2.92E+01	2.27E+01	1.87E+01	1.60E+01	1.49E+01
65	1.68E+01	1.05E+01	7.25E+00	5.44E+00	4.36E+00	3.66E+00	3.38E+00
66	2.21E+02	1.40E+02	9.73E+01	7.35E+01	5.91E+01	4.98E+01	4.61E+01
67	3.14E+02	2.00E+02	1.40E+02	1.07E+02	8.65E+01	7.34E+01	6.82E+01
68	2.82E+02	1.82E+02	1.30E+02	1.01E+02	8.27E+01	7.08E+01	6.61E+01
69	2.82E+02	1.81E+02	1.27E+02	9.66E+01	7.77E+01	6.53E+01	6.03E+01
70	3.12E+02	2.04E+02	1.46E+02	1.12E+02	9.09E+01	7.70E+01	7.14E+01

TABLE A5. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
71	2.74E+02	1.78E+02	1.26E+02	9.57E+01	7.71E+01	6.47E+01	5.98E+01
72	2.61E+01	1.73E+01	1.28E+01	1.03E+01	8.73E+00	7.71E+00	7.31E+00
73	6.15E+00	3.74E+00	2.54E+00	1.91E+00	1.55E+00	1.31E+00	1.23E+00
74	9.49E+01	5.81E+01	3.93E+01	2.89E+01	2.28E+01	1.89E+01	1.74E+01
75	1.44E+02	9.02E+01	6.21E+01	4.63E+01	3.67E+01	3.04E+01	2.79E+01
76	1.26E+02	7.88E+01	5.47E+01	4.14E+01	3.35E+01	2.84E+01	2.64E+01
77	1.20E+02	7.34E+01	4.99E+01	3.70E+01	2.95E+01	2.47E+01	2.28E+01
78	1.38E+02	8.75E+01	6.14E+01	4.69E+01	3.83E+01	3.25E+01	3.03E+01
79	1.28E+02	8.21E+01	5.74E+01	4.30E+01	3.41E+01	2.82E+01	2.58E+01
80	1.62E+01	1.07E+01	7.96E+00	6.42E+00	5.50E+00	4.88E+00	4.64E+00
81	3.63E+00	1.66E+00	8.35E-01	4.79E-01	3.23E-01	2.48E-01	2.25E-01
82	4.07E+01	2.54E+01	1.74E+01	1.29E+01	1.02E+01	8.49E+00	7.80E+00
83	5.33E+01	3.17E+01	2.09E+01	1.52E+01	1.18E+01	9.77E+00	8.96E+00
84	5.44E+01	3.33E+01	2.26E+01	1.69E+01	1.35E+01	1.13E+01	1.05E+01
85	5.45E+01	3.16E+01	2.02E+01	1.41E+01	1.06E+01	8.46E+00	7.63E+00
86	6.13E+01	3.67E+01	2.42E+01	1.74E+01	1.33E+01	1.08E+01	9.83E+00
87	5.03E+01	3.16E+01	2.20E+01	1.67E+01	1.36E+01	1.15E+01	1.07E+01
88	7.31E+00	5.33E+00	4.21E+00	3.51E+00	3.06E+00	2.73E+00	2.60E+00
89	3.32E+00	2.18E+00	1.67E+00	1.43E+00	1.32E+00	1.21E+00	1.19E+00
90	1.58E+01	8.99E+00	5.72E+00	4.03E+00	3.09E+00	2.53E+00	2.31E+00
91	2.48E+01	1.40E+01	8.88E+00	6.31E+00	4.92E+00	4.09E+00	3.78E+00
92	2.28E+01	1.36E+01	9.20E+00	6.95E+00	5.72E+00	4.96E+00	4.67E+00
93	2.22E+01	1.20E+01	7.26E+00	4.87E+00	3.60E+00	2.86E+00	2.58E+00
94	3.16E+01	1.95E+01	1.33E+01	9.87E+00	7.81E+00	6.47E+00	5.95E+00
95	2.40E+01	1.53E+01	1.10E+01	8.78E+00	7.48E+00	6.52E+00	6.29E+00
96	2.40E+00	1.70E+00	1.32E+00	1.10E+00	9.70E-01	8.73E-01	8.35E-01
97	6.00E-01	2.48E-01	1.03E-01	4.31E-02	1.87E-02	8.56E-03	5.85E-03
98	2.56E+00	1.42E+00	8.64E-01	5.79E-01	4.22E-01	3.29E-01	2.94E-01
99	5.43E+00	2.81E+00	1.64E+00	1.09E+00	8.21E-01	6.72E-01	6.20E-01
100	5.23E+00	2.41E+00	1.22E+00	6.95E-01	4.60E-01	3.48E-01	3.12E-01
101	4.22E+00	2.12E+00	1.18E+00	7.34E-01	5.12E-01	3.91E-01	3.48E-01
102	5.41E+00	2.83E+00	1.63E+00	1.05E+00	7.55E-01	5.86E-01	5.28E-01
103	5.28E+00	3.06E+00	2.02E+00	1.50E+00	1.22E+00	1.05E+00	9.82E-01
104	1.15E+00	7.13E-01	4.84E-01	3.55E-01	2.76E-01	2.24E-01	2.04E-01

TABLE A6. The calculated absorbed dose rate (rad/h to LiF) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be filled with WATER.

DETECTOR NO.	RAD PER HOUR							
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.	
1	4.25E+04	3.01E+04	2.28E+04	1.81E+04	1.50E+04	1.29E+04	1.28E+04	
2	5.09E+04	3.62E+04	2.75E+04	2.20E+04	1.84E+04	1.60E+04	1.49E+04	
3	5.24E+04	3.73E+04	2.84E+04	2.27E+04	1.90E+04	1.64E+04	1.53E+04	
4	5.30E+04	3.77E+04	2.87E+04	2.30E+04	1.93E+04	1.67E+04	1.56E+04	
5	5.34E+04	3.82E+04	2.91E+04	2.35E+04	1.97E+04	1.71E+04	1.68E+04	
6	4.33E+04	3.06E+04	2.32E+04	1.85E+04	1.55E+04	1.33E+04	1.25E+04	
7	1.46E+04	1.02E+04	7.66E+03	6.07E+03	5.04E+03	4.32E+03	4.03E+03	
8	1.86E+04	1.31E+04	9.92E+03	7.93E+03	6.63E+03	5.73E+03	5.36E+03	
9	1.90E+04	1.34E+04	1.02E+04	8.12E+03	6.78E+03	5.86E+03	5.48E+03	
10	1.91E+04	1.35E+04	1.02E+04	8.10E+03	6.75E+03	5.81E+03	5.42E+03	
11	1.85E+04	1.31E+04	9.85E+03	7.85E+03	6.55E+03	5.65E+03	5.28E+03	
12	7.70E+03	5.34E+03	4.26E+03	3.74E+03	3.46E+03	3.29E+03	3.23E+03	
13	8.62E+03	6.03E+03	4.52E+03	3.58E+03	2.96E+03	2.54E+03	2.36E+03	
14	1.13E+04	7.97E+03	6.05E+03	4.86E+03	4.08E+03	3.55E+03	3.33E+03	
15	1.19E+04	8.39E+03	6.35E+03	5.07E+03	4.23E+03	3.65E+03	3.41E+03	
16	1.15E+04	8.11E+03	6.16E+03	4.94E+03	4.14E+03	3.59E+03	3.36E+03	
17	1.14E+04	7.95E+03	5.96E+03	4.72E+03	3.91E+03	3.35E+03	3.13E+03	
18	9.37E+03	6.58E+03	4.96E+03	3.95E+03	3.30E+03	2.84E+03	2.66E+03	
19	4.35E+03	3.02E+03	2.25E+03	1.77E+03	1.46E+03	1.24E+03	1.15E+03	
20	5.67E+03	3.96E+03	2.97E+03	2.36E+03	1.97E+03	1.70E+03	1.59E+03	
21	6.15E+03	4.32E+03	3.24E+03	2.57E+03	2.12E+03	1.82E+03	1.69E+03	
22	5.90E+03	4.12E+03	3.09E+03	2.45E+03	2.03E+03	1.74E+03	1.62E+03	
23	5.96E+03	4.18E+03	3.14E+03	2.49E+03	2.07E+03	1.77E+03	1.65E+03	
24	4.90E+03	3.43E+03	2.57E+03	2.04E+03	1.70E+03	1.46E+03	1.36E+03	
25	1.91E+02	1.27E+02	9.13E+01	6.99E+01	5.63E+01	4.71E+01	4.34E+01	
26	2.72E+03	1.90E+03	1.42E+03	1.14E+03	9.48E+02	8.19E+02	7.66E+02	
27	3.53E+03	2.43E+03	1.81E+03	1.43E+03	1.19E+03	1.03E+03	9.59E+02	
28	3.82E+03	2.67E+03	2.00E+03	1.59E+03	1.32E+03	1.14E+03	1.06E+03	
29	3.02E+03	1.89E+03	1.25E+03	8.56E+02	6.08E+02	4.42E+02	3.76E+02	
30	3.88E+03	2.68E+03	1.99E+03	1.56E+03	1.28E+03	1.09E+03	1.01E+03	
31	3.13E+03	2.18E+03	1.64E+03	1.31E+03	1.09E+03	9.39E+02	8.78E+02	
32	2.23E+02	1.53E+02	1.15E+02	9.20E+01	7.74E+01	6.74E+01	6.33E+01	
33	1.35E+02	9.09E+01	6.62E+01	5.12E+01	4.16E+01	3.51E+01	3.25E+01	
34	1.82E+03	1.25E+03	9.27E+02	7.27E+02	5.98E+02	5.10E+02	4.74E+02	
35	2.47E+03	1.72E+03	1.29E+03	1.04E+03	8.73E+02	7.60E+02	7.14E+02	

TABLE A6. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	2.41E+03	1.67E+03	1.24E+03	9.90E+02	8.26E+02	7.15E+02	6.69E+02
37	2.47E+03	1.71E+03	1.28E+03	1.01E+03	8.37E+02	7.18E+02	6.70E+02
38	2.02E+03	1.53E+03	1.21E+03	9.83E+02	8.26E+02	7.12E+02	6.65E+02
39	2.18E+03	1.51E+03	1.12E+03	8.76E+02	7.18E+02	6.10E+02	5.66E+02
40	1.48E+02	1.02E+02	7.55E+01	5.97E+01	4.96E+01	4.27E+01	3.98E+01
41	1.15E+02	7.70E+01	5.40E+01	3.94E+01	2.97E+01	2.31E+01	2.04E+01
42	1.18E+03	7.97E+02	5.81E+02	4.50E+02	3.66E+02	3.09E+02	2.86E+02
43	1.60E+03	1.09E+03	7.92E+02	6.13E+02	4.99E+02	4.21E+02	3.89E+02
44	1.51E+03	1.04E+03	7.72E+02	6.14E+02	5.13E+02	4.45E+02	4.17E+02
45	1.63E+03	1.12E+03	8.28E+02	6.53E+02	5.41E+02	4.65E+02	4.34E+02
46	1.57E+03	1.07E+03	7.91E+02	6.21E+02	5.12E+02	4.38E+02	4.08E+02
47	1.40E+03	9.64E+02	7.12E+02	5.58E+02	4.59E+02	3.92E+02	3.64E+02
48	9.15E+01	6.13E+01	4.55E+01	3.64E+01	3.09E+01	2.72E+01	2.57E+01
49	4.05E+01	2.53E+01	1.74E+01	1.29E+01	1.03E+01	8.58E+00	7.91E+00
50	7.40E+02	4.99E+02	3.65E+02	2.85E+02	2.35E+02	2.01E+02	1.87E+02
51	9.37E+02	6.25E+02	4.55E+02	3.55E+02	2.93E+02	2.51E+02	2.34E+02
52	1.01E+03	6.73E+02	4.90E+02	3.82E+02	3.13E+02	2.67E+02	2.48E+02
53	1.04E+03	7.01E+02	5.11E+02	3.97E+02	3.25E+02	2.76E+02	2.57E+02
54	1.05E+03	7.04E+02	5.11E+02	3.94E+02	3.20E+02	2.69E+02	2.49E+02
55	9.06E+02	6.11E+02	4.44E+02	3.42E+02	2.77E+02	2.33E+02	2.15E+02
56	2.22E+02	1.95E+02	1.81E+02	1.71E+02	1.64E+02	1.59E+02	1.56E+02
57	2.01E+01	1.27E+01	9.22E+00	7.43E+00	6.44E+00	5.82E+00	5.58E+00
58	2.92E+02	1.91E+02	1.37E+02	1.06E+02	8.72E+01	7.46E+01	6.95E+01
59	4.47E+02	2.91E+02	2.08E+02	1.60E+02	1.31E+02	1.12E+02	1.04E+02
60	4.36E+02	2.89E+02	2.11E+02	1.67E+02	1.39E+02	1.20E+02	1.13E+02
61	4.55E+02	2.99E+02	2.13E+02	1.63E+02	1.32E+02	1.11E+02	1.03E+02
62	4.55E+02	2.98E+02	2.12E+02	1.62E+02	1.30E+02	1.09E+02	1.01E+02
63	3.81E+02	2.57E+02	1.89E+02	1.48E+02	1.21E+02	1.04E+02	9.65E+01
64	1.68E+02	7.58E+01	3.67E+01	1.99E+01	1.24E+01	8.92E+00	7.84E+00
65	1.37E+01	9.78E+00	7.72E+00	6.54E+00	5.82E+00	5.32E+00	5.12E+00
66	1.46E+02	9.42E+01	6.74E+01	5.25E+01	4.36E+01	3.78E+01	3.54E+01
67	1.82E+02	1.12E+02	7.69E+01	5.80E+01	4.70E+01	4.01E+01	3.74E+01
68	1.69E+02	1.07E+02	7.50E+01	5.71E+01	4.64E+01	3.94E+01	3.66E+01
69	1.71E+02	1.09E+02	7.56E+01	5.68E+01	4.52E+01	3.77E+01	3.47E+01
70	2.04E+02	1.31E+02	9.08E+01	6.77E+01	5.35E+01	4.41E+01	4.03E+01

TABLE A6. (Continued.)

DETECTOR NO.	RAD PER HOUR							
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.	
71	1.97E+02	1.31E+02	9.38E+01	7.14E+01	5.71E+01	4.74E+01	4.35E+01	
72	1.37E+01	8.58E+00	6.01E+00	4.61E+00	3.79E+00	3.26E+00	3.05E+00	
73	3.09E+00	1.71E+00	1.05E+00	7.08E-01	5.23E-01	4.13E-01	3.71E-01	
74	6.04E+01	3.68E+01	2.50E+01	1.85E+01	1.47E+01	1.23E+01	1.14E+01	
75	6.53E+01	3.64E+01	2.30E+01	1.63E+01	1.28E+01	1.08E+01	1.00E+01	
76	7.76E+01	4.64E+01	3.10E+01	2.29E+01	1.82E+01	1.54E+01	1.42E+01	
77	6.76E+01	4.09E+01	2.76E+01	2.04E+01	1.63E+01	1.38E+01	1.28E+01	
78	8.87E+01	5.45E+01	3.67E+01	2.67E+01	2.07E+01	1.68E+01	1.53E+01	
79	8.00E+01	5.09E+01	3.57E+01	2.72E+01	2.21E+01	1.87E+01	1.74E+01	
80	5.16E+00	3.20E+00	2.22E+00	1.69E+00	1.38E+00	1.18E+00	1.10E+00	
81	2.36E+00	1.29E+00	7.61E-01	4.81E-01	3.22E-01	2.24E-01	1.87E-01	
82	2.24E+01	1.30E+01	8.47E+00	6.10E+00	4.78E+00	3.97E+00	3.66E+00	
83	3.17E+01	1.69E+01	1.01E+01	6.93E+00	5.29E+00	4.38E+00	4.05E+00	
84	3.68E+01	2.15E+01	1.42E+01	1.05E+01	8.42E+00	7.19E+00	6.72E+00	
85	3.00E+01	1.69E+01	1.07E+01	7.50E+00	5.78E+00	4.75E+00	4.37E+00	
86	3.25E+01	1.85E+01	1.17E+01	8.11E+00	6.11E+00	4.89E+00	4.43E+00	
87	3.13E+01	1.87E+01	1.25E+01	9.22E+00	7.34E+00	6.17E+00	5.72E+00	
88	3.55E+00	2.44E+00	1.89E+00	1.58E+00	1.39E+00	1.27E+00	1.22E+00	
89	5.01E-01	2.08E-01	8.68E-02	3.69E-02	1.64E-02	7.90E-03	5.61E-03	
90	1.02E+01	5.55E+00	3.29E+00	2.12E+00	1.47E+00	1.08E+00	9.39E-01	
91	1.55E+01	7.68E+00	4.26E+00	2.70E+00	1.96E+00	1.57E+00	1.44E+00	
92	2.03E+01	1.10E+01	6.72E+00	4.58E+00	3.45E+00	2.79E+00	2.54E+00	
93	1.25E+01	6.71E+00	4.04E+00	2.76E+00	2.10E+00	1.73E+00	1.59E+00	
94	1.78E+01	9.72E+00	5.79E+00	3.77E+00	2.65E+00	1.99E+00	1.74E+00	
95	1.61E+01	9.66E+00	6.48E+00	4.80E+00	3.84E+00	3.24E+00	3.01E+00	
96	3.16E+00	2.33E+00	1.89E+00	1.62E+00	1.45E+00	1.33E+00	1.28E+00	
97	4.18E-02	2.64E-02	1.98E-02	1.69E-02	1.55E-02	1.47E-02	1.44E-02	
98	2.49E+00	1.31E+00	7.47E-01	4.58E-01	3.00E-01	2.06E-01	1.71E-01	
99	3.83E+00	1.65E+00	7.45E-01	3.67E-01	2.09E-01	1.42E-01	1.23E-01	
100	4.20E+00	1.81E+00	8.31E-01	4.22E-01	2.53E-01	1.81E-01	1.60E-01	
101	2.23E+00	1.17E+00	6.85E-01	4.56E-01	3.40E-01	2.75E-01	2.52E-01	
102	2.29E+00	1.12E+00	5.90E-01	3.31E-01	2.00E-01	1.28E-01	1.02E-01	
103	3.42E+00	1.75E+00	1.01E+00	6.57E-01	4.85E-01	3.91E-01	3.58E-01	
104	8.29E-01	5.50E-01	4.30E-01	3.76E-01	3.50E-01	3.34E-01	3.28E-01	

**TABLE A7.** The calculated absorbed dose rate (rad/h to LiF) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be filled with COMPACTED BENTONITE.

DETECTOR NO.	RAD PER HOUR							
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.	
1	4.22E+04	2.99E+04	2.27E+04	1.81E+04	1.51E+04	1.30E+04	1.21E+04	
2	5.09E+04	3.62E+04	2.75E+04	2.20E+04	1.84E+04	1.59E+04	1.49E+04	
3	5.20E+04	3.70E+04	2.82E+04	2.26E+04	1.89E+04	1.63E+04	1.52E+04	
4	5.47E+04	3.88E+04	2.95E+04	2.37E+04	1.98E+04	1.72E+04	1.61E+04	
5	5.39E+04	3.83E+04	2.91E+04	2.33E+04	1.95E+04	1.68E+04	1.58E+04	
6	4.30E+04	3.05E+04	2.31E+04	1.85E+04	1.54E+04	1.33E+04	1.25E+04	
7	1.48E+04	1.03E+04	7.77E+03	6.17E+03	5.13E+03	4.41E+03	4.11E+03	
8	1.87E+04	1.32E+04	1.00E+04	7.99E+03	6.67E+03	5.75E+03	5.38E+03	
9	1.90E+04	1.34E+04	1.02E+04	8.14E+03	6.80E+03	5.87E+03	5.49E+03	
10	1.95E+04	1.37E+04	1.04E+04	8.24E+03	6.84E+03	5.88E+03	5.48E+03	
11	1.89E+04	1.33E+04	1.00E+04	7.98E+03	6.64E+03	5.72E+03	5.34E+03	
12	1.58E+04	1.11E+04	8.40E+03	6.71E+03	5.60E+03	4.83E+03	4.51E+03	
13	8.93E+03	6.24E+03	4.66E+03	3.68E+03	3.04E+03	2.60E+03	2.42E+03	
14	1.14E+04	8.03E+03	6.06E+03	4.84E+03	4.04E+03	3.50E+03	3.27E+03	
15	1.20E+04	8.46E+03	6.40E+03	5.10E+03	4.25E+03	3.67E+03	3.42E+03	
16	1.19E+04	8.40E+03	6.33E+03	5.03E+03	4.18E+03	3.59E+03	3.35E+03	
17	1.17E+04	8.21E+03	6.17E+03	4.90E+03	4.07E+03	3.49E+03	3.25E+03	
18	9.64E+03	6.74E+03	5.05E+03	4.01E+03	3.33E+03	2.86E+03	2.67E+03	
19	2.88E+03	2.01E+03	1.50E+03	1.19E+03	9.88E+02	8.49E+02	7.93E+02	
20	3.79E+03	2.66E+03	2.01E+03	1.61E+03	1.35E+03	1.17E+03	1.10E+03	
21	3.95E+03	2.74E+03	2.04E+03	1.61E+03	1.32E+03	1.13E+03	1.05E+03	
22	3.93E+03	2.73E+03	2.03E+03	1.61E+03	1.33E+03	1.14E+03	1.06E+03	
23	3.92E+03	2.72E+03	2.03E+03	1.61E+03	1.33E+03	1.15E+03	1.07E+03	
24	3.17E+03	2.19E+03	1.63E+03	1.28E+03	1.06E+03	9.11E+02	8.49E+02	
25	1.01E+02	7.24E+01	5.74E+01	4.89E+01	4.36E+01	4.00E+01	3.85E+01	
26	1.92E+03	1.31E+03	9.66E+02	7.52E+02	6.14E+02	5.19E+02	4.81E+02	
27	2.43E+03	1.67E+03	1.23E+03	9.69E+02	7.98E+02	6.82E+02	6.34E+02	
28	2.52E+03	1.74E+03	1.29E+03	1.02E+03	8.48E+02	7.29E+02	6.80E+02	
29	2.52E+03	1.75E+03	1.30E+03	1.03E+03	8.50E+02	7.29E+02	6.79E+02	
30	2.53E+03	1.74E+03	1.29E+03	1.02E+03	8.45E+02	7.24E+02	6.75E+02	
31	2.10E+03	1.44E+03	1.06E+03	8.36E+02	6.90E+02	5.91E+02	5.51E+02	
32	1.10E+02	7.47E+01	5.54E+01	4.41E+01	3.71E+01	3.23E+01	3.03E+01	
33	6.31E+01	4.00E+01	2.74E+01	2.00E+01	1.54E+01	1.23E+01	1.11E+01	
34	1.19E+03	8.05E+02	5.88E+02	4.55E+02	3.70E+02	3.12E+02	2.88E+02	
35	1.45E+03	9.80E+02	7.20E+02	5.65E+02	4.67E+02	4.01E+02	3.74E+02	

TABLE A7. (Continued.)

RAD PER HOUR							
DETECTOR NO.	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	1.54E+03	1.04E+03	7.65E+02	5.97E+02	4.91E+02	4.19E+02	3.89E+02
37	1.65E+03	1.12E+03	8.27E+02	6.48E+02	5.33E+02	4.55E+02	4.23E+02
38	1.63E+03	1.12E+03	8.32E+02	6.56E+02	5.44E+02	4.67E+02	4.35E+02
39	1.35E+03	9.20E+02	6.77E+02	5.31E+02	4.38E+02	3.75E+02	3.49E+02
40	7.13E+01	4.75E+01	3.50E+01	2.79E+01	2.36E+01	2.07E+01	1.96E+01
41	3.35E+01	2.13E+01	1.50E+01	1.15E+01	9.32E+00	7.93E+00	7.38E+00
42	7.53E+02	4.94E+02	3.52E+02	2.70E+02	2.18E+02	1.84E+02	1.70E+02
43	9.39E+02	6.29E+02	4.59E+02	3.59E+02	2.95E+02	2.52E+02	2.35E+02
44	9.66E+02	6.45E+02	4.69E+02	3.65E+02	2.99E+02	2.55E+02	2.38E+02
45	1.09E+03	7.38E+02	5.42E+02	4.24E+02	3.49E+02	2.98E+02	2.77E+02
46	1.07E+03	7.21E+02	5.24E+02	4.06E+02	3.30E+02	2.79E+02	2.58E+02
47	9.04E+02	6.09E+02	4.43E+02	3.43E+02	2.80E+02	2.37E+02	2.19E+02
48	5.33E+01	3.51E+01	2.53E+01	1.95E+01	1.60E+01	1.36E+01	1.27E+01
49	3.39E+01	1.97E+01	1.31E+01	9.70E+00	7.88E+00	6.79E+00	6.38E+00
50	4.72E+02	3.11E+02	2.24E+02	1.74E+02	1.43E+02	1.22E+02	1.13E+02
51	6.47E+02	4.27E+02	3.07E+02	2.36E+02	1.91E+02	1.61E+02	1.49E+02
52	6.28E+02	4.20E+02	3.06E+02	2.39E+02	1.97E+02	1.69E+02	1.58E+02
53	6.93E+02	4.63E+02	3.35E+02	2.59E+02	2.10E+02	1.78E+02	1.64E+02
54	7.03E+02	4.70E+02	3.40E+02	2.63E+02	2.13E+02	1.80E+02	1.66E+02
55	5.76E+02	3.83E+02	2.77E+02	2.14E+02	1.74E+02	1.48E+02	1.37E+02
56	3.07E+01	2.04E+01	1.50E+01	1.20E+01	1.01E+01	8.91E+00	8.42E+00
57	2.37E+01	1.60E+01	1.15E+01	8.71E+00	6.91E+00	5.68E+00	5.17E+00
58	2.22E+02	1.43E+02	1.01E+02	7.74E+01	6.32E+01	5.39E+01	5.02E+01
59	2.71E+02	1.73E+02	1.22E+02	9.23E+01	7.43E+01	6.25E+01	5.78E+01
60	2.59E+02	1.67E+02	1.19E+02	9.14E+01	7.48E+01	6.39E+01	5.95E+01
61	2.62E+02	1.66E+02	1.16E+02	8.78E+01	7.05E+01	5.93E+01	5.48E+01
62	2.76E+02	1.81E+02	1.29E+02	9.92E+01	8.05E+01	6.81E+01	6.32E+01
63	2.95E+02	1.99E+02	1.47E+02	1.18E+02	9.95E+01	8.74E+01	8.24E+01
64	1.60E+01	1.05E+01	7.62E+00	5.97E+00	4.96E+00	4.29E+00	4.01E+00
65	5.07E+00	3.13E+00	2.22E+00	1.75E+00	1.49E+00	1.34E+00	1.28E+00
66	8.92E+01	5.27E+01	3.47E+01	2.51E+01	1.97E+01	1.64E+01	1.51E+01
67	1.12E+02	6.80E+01	4.56E+01	3.34E+01	2.62E+01	2.16E+01	1.99E+01
68	1.11E+02	6.84E+01	4.65E+01	3.44E+01	2.72E+01	2.26E+01	2.08E+01
69	1.11E+02	6.94E+01	4.81E+01	3.64E+01	2.94E+01	2.49E+01	2.32E+01
70	1.24E+02	7.97E+01	5.62E+01	4.28E+01	3.47E+01	2.94E+01	2.72E+01

TABLE A7. (Continued.)

RAD PER HOUR							
DETECTOR NO.	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
71	1.10E+02	6.92E+01	4.83E+01	3.68E+01	3.00E+01	2.56E+01	2.39E+01
72	9.55E+00	6.15E+00	4.33E+00	3.27E+00	2.62E+00	2.18E+00	2.00E+00
73	2.80E+00	1.45E+00	8.58E-01	5.92E-01	4.66E-01	4.01E-01	3.79E-01
74	3.91E+01	2.30E+01	1.50E+01	1.08E+01	8.37E+00	6.88E+00	6.31E+00
75	4.84E+01	2.73E+01	1.71E+01	1.18E+01	8.85E+00	7.07E+00	6.39E+00
76	5.01E+01	2.94E+01	1.93E+01	1.41E+01	1.12E+01	9.40E+00	8.74E+00
77	4.94E+01	2.96E+01	1.97E+01	1.44E+01	1.13E+01	9.39E+00	8.64E+00
78	6.82E+01	4.44E+01	3.15E+01	2.40E+01	1.95E+01	1.64E+01	1.51E+01
79	4.20E+01	2.50E+01	1.69E+01	1.28E+01	1.05E+01	9.17E+00	8.65E+00
80	4.05E+00	2.37E+00	1.53E+00	1.08E+00	8.25E-01	6.62E-01	5.98E-01
81	9.29E-01	3.98E-01	1.75E-01	8.08E-02	4.10E-02	2.39E-02	1.91E-02
82	1.61E+01	8.48E+00	4.98E+00	3.26E+00	2.37E+00	1.86E+00	1.68E+00
83	2.29E+01	1.25E+01	7.68E+00	5.24E+00	3.93E+00	3.17E+00	2.88E+00
84	2.14E+01	1.20E+01	7.50E+00	5.24E+00	4.01E+00	3.28E+00	3.01E+00
85	2.14E+01	1.25E+01	8.25E+00	6.06E+00	4.86E+00	4.11E+00	3.83E+00
86	2.62E+01	1.57E+01	1.03E+01	7.29E+00	5.54E+00	4.43E+00	4.00E+00
87	2.12E+01	1.22E+01	7.95E+00	5.87E+00	4.76E+00	4.12E+00	3.87E+00
88	2.85E+00	1.49E+00	8.63E-01	5.51E-01	3.85E-01	2.89E-01	2.53E-01
89	2.67E-01	1.11E-01	4.67E-02	2.02E-02	9.31E-03	4.77E-03	3.56E-03
90	7.38E+00	3.86E+00	2.22E+00	1.40E+00	9.69E-01	7.20E-01	6.29E-01
91	1.12E+01	5.53E+00	3.02E+00	1.87E+00	1.32E+00	1.03E+00	9.30E-01
92	1.06E+01	5.97E+00	3.80E+00	2.72E+00	2.13E+00	1.78E+00	1.65E+00
93	9.65E+00	5.40E+00	3.39E+00	2.37E+00	1.81E+00	1.47E+00	1.35E+00
94	1.97E+01	1.22E+01	7.99E+00	5.50E+00	3.95E+00	2.91E+00	2.58E+00
95	1.13E+01	6.79E+00	4.57E+00	3.40E+00	2.74E+00	2.33E+00	2.17E+00
96	1.57E+00	8.54E-01	5.17E-01	3.48E-01	2.56E-01	2.01E-01	1.81E-01
97	2.36E-03	2.15E-03	2.03E-03	1.95E-03	1.91E-03	1.81E-03	1.79E-03
98	9.13E-01	4.68E-01	2.77E-01	1.94E-01	1.56E-01	1.37E-01	1.31E-01
99	2.22E+00	9.40E-01	4.07E-01	1.83E-01	8.73E-02	4.52E-02	3.30E-02
100	2.83E+00	1.43E+00	8.06E-01	5.14E-01	3.69E-01	2.87E-01	2.59E-01
101	2.30E+00	1.13E+00	6.07E-01	3.55E-01	2.28E-01	1.56E-01	1.31E-01
102	1.70E+00	8.92E-01	5.17E-01	3.32E-01	2.36E-01	1.79E-01	1.59E-01
103	2.84E+00	1.40E+00	7.68E-01	4.80E-01	3.42E-01	2.70E-01	2.45E-01
104	7.40E-01	5.39E-01	4.52E-01	4.10E-01	3.88E-01	3.74E-01	3.68E-01

TABLE A8. The calculated absorbed dose rate (rad/h to LiF) at several calculational boundaries (cf. Fig. 4) and at various elapsed times since discharge of fuel from reactor. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
1	4.41E+04	3.12E+04	2.35E+04	1.87E+04	1.55E+04	1.32E+04	1.23E+04
2	5.04E+04	3.58E+04	2.72E+04	2.18E+04	1.82E+04	1.58E+04	1.48E+04
3	5.26E+04	3.75E+04	2.85E+04	2.28E+04	1.90E+04	1.64E+04	1.53E+04
4	5.33E+04	3.79E+04	2.89E+04	2.33E+04	1.96E+04	1.70E+04	1.59E+04
5	5.35E+04	3.81E+04	2.90E+04	2.33E+04	1.95E+04	1.69E+04	1.59E+04
6	4.45E+04	3.15E+04	2.38E+04	1.90E+04	1.58E+04	1.36E+04	1.27E+04
7	1.48E+04	1.04E+04	7.84E+03	6.23E+03	5.17E+03	4.44E+03	4.14E+03
8	1.88E+04	1.33E+04	1.00E+04	8.02E+03	6.70E+03	5.79E+03	5.41E+03
9	1.92E+04	1.36E+04	1.03E+04	8.23E+03	6.86E+03	5.92E+03	5.53E+03
10	1.86E+04	1.31E+04	9.89E+03	7.88E+03	6.57E+03	5.66E+03	5.29E+03
11	1.89E+04	1.34E+04	1.01E+04	8.06E+03	6.71E+03	5.78E+03	5.42E+03
12	1.61E+04	1.13E+04	8.53E+03	6.78E+03	5.64E+03	4.85E+03	4.52E+03
13	9.09E+03	6.36E+03	4.77E+03	3.77E+03	3.12E+03	2.67E+03	2.48E+03
14	1.17E+04	8.29E+03	6.26E+03	4.99E+03	4.16E+03	3.58E+03	3.34E+03
15	1.18E+04	8.37E+03	6.34E+03	5.07E+03	4.23E+03	3.65E+03	3.42E+03
16	1.14E+04	8.03E+03	6.05E+03	4.82E+03	4.02E+03	3.46E+03	3.23E+03
17	1.18E+04	8.28E+03	6.23E+03	4.95E+03	4.11E+03	3.53E+03	3.29E+03
18	9.45E+03	6.63E+03	4.99E+03	3.97E+03	3.31E+03	2.85E+03	2.66E+03
19	2.88E+03	1.99E+03	1.48E+03	1.17E+03	9.60E+02	8.18E+02	7.61E+02
20	3.68E+03	2.57E+03	1.94E+03	1.54E+03	1.28E+03	1.11E+03	1.03E+03
21	3.73E+03	2.60E+03	1.94E+03	1.54E+03	1.28E+03	1.10E+03	1.03E+03
22	3.67E+03	2.56E+03	1.92E+03	1.54E+03	1.29E+03	1.12E+03	1.05E+03
23	3.86E+03	2.68E+03	1.99E+03	1.57E+03	1.30E+03	1.11E+03	1.04E+03
24	3.27E+03	2.27E+03	1.68E+03	1.33E+03	1.09E+03	9.31E+02	8.65E+02
25	1.14E+02	7.54E+01	5.36E+01	4.04E+01	3.20E+01	2.63E+01	2.41E+01
26	1.83E+03	1.25E+03	9.15E+02	7.12E+02	5.82E+02	4.93E+02	4.57E+02
27	2.35E+03	1.62E+03	1.21E+03	9.52E+02	7.89E+02	6.77E+02	6.32E+02
28	2.51E+03	1.73E+03	1.28E+03	1.01E+03	8.33E+02	7.13E+02	6.64E+02
29	2.35E+03	1.62E+03	1.20E+03	9.51E+02	7.91E+02	6.81E+02	6.37E+02
30	2.38E+03	1.65E+03	1.23E+03	9.74E+02	8.09E+02	6.96E+02	6.50E+02
31	2.03E+03	1.40E+03	1.03E+03	8.13E+02	6.70E+02	5.72E+02	5.32E+02
32	1.32E+02	9.09E+01	6.83E+01	5.48E+01	4.62E+01	4.03E+01	3.79E+01
33	8.05E+01	5.33E+01	3.80E+01	2.89E+01	2.31E+01	1.91E+01	1.76E+01
34	1.19E+03	8.04E+02	5.84E+02	4.49E+02	3.63E+02	3.04E+02	2.81E+02
35	1.46E+03	9.99E+02	7.39E+02	5.82E+02	4.82E+02	4.14E+02	3.86E+02

TABLE A8. (Continued.)

DETECTOR NO.	RAD PER HOUR						
	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
36	1.55E+03	1.06E+03	7.78E+02	6.11E+02	5.04E+02	4.32E+02	4.02E+02
37	1.51E+03	1.03E+03	7.60E+02	5.99E+02	4.97E+02	4.28E+02	4.00E+02
38	1.53E+03	1.04E+03	7.69E+02	6.02E+02	4.96E+02	4.24E+02	3.95E+02
39	1.23E+03	8.38E+02	6.19E+02	4.88E+02	4.05E+02	3.49E+02	3.26E+02
40	1.04E+02	7.09E+01	5.19E+01	4.02E+01	3.26E+01	2.74E+01	2.53E+01
41	5.54E+01	3.61E+01	2.53E+01	1.89E+01	1.49E+01	1.22E+01	1.11E+01
42	7.44E+02	4.95E+02	3.57E+02	2.74E+02	2.22E+02	1.86E+02	1.72E+02
43	9.41E+02	6.34E+02	4.63E+02	3.61E+02	2.96E+02	2.53E+02	2.35E+02
44	9.75E+02	6.58E+02	4.82E+02	3.78E+02	3.12E+02	2.67E+02	2.49E+02
45	9.48E+02	6.30E+02	4.59E+02	3.59E+02	2.97E+02	2.55E+02	2.39E+02
46	9.85E+02	6.66E+02	4.88E+02	3.81E+02	3.14E+02	2.68E+02	2.49E+02
47	7.75E+02	5.20E+02	3.81E+02	2.99E+02	2.48E+02	2.13E+02	1.99E+02
48	8.56E+01	5.95E+01	4.38E+01	3.37E+01	2.70E+01	2.23E+01	2.04E+01
49	3.95E+01	2.55E+01	1.78E+01	1.34E+01	1.06E+01	8.78E+00	8.05E+00
50	4.94E+02	3.24E+02	2.32E+02	1.78E+02	1.45E+02	1.22E+02	1.14E+02
51	6.23E+02	4.06E+02	2.90E+02	2.22E+02	1.80E+02	1.53E+02	1.42E+02
52	6.37E+02	4.25E+02	3.09E+02	2.40E+02	1.96E+02	1.67E+02	1.55E+02
53	6.06E+02	3.99E+02	2.87E+02	2.22E+02	1.82E+02	1.55E+02	1.44E+02
54	6.28E+02	4.18E+02	3.02E+02	2.33E+02	1.90E+02	1.61E+02	1.50E+02
55	5.17E+02	3.47E+02	2.54E+02	1.99E+02	1.65E+02	1.42E+02	1.32E+02
56	5.35E+01	3.75E+01	2.85E+01	2.29E+01	1.93E+01	1.69E+01	1.58E+01
57	1.76E+01	1.10E+01	7.54E+00	5.59E+00	4.41E+00	3.65E+00	3.35E+00
58	2.07E+02	1.32E+02	9.25E+01	7.01E+01	5.66E+01	4.77E+01	4.42E+01
59	3.13E+02	2.04E+02	1.45E+02	1.12E+02	9.08E+01	7.71E+01	7.15E+01
60	2.68E+02	1.72E+02	1.21E+02	9.14E+01	7.33E+01	6.14E+01	5.66E+01
61	2.59E+02	1.62E+02	1.12E+02	8.39E+01	6.72E+01	5.65E+01	5.22E+01
62	2.52E+02	1.64E+02	1.16E+02	8.84E+01	7.13E+01	6.00E+01	5.55E+01
63	2.29E+02	1.52E+02	1.12E+02	8.95E+01	7.61E+01	6.73E+01	6.38E+01
64	2.13E+01	1.38E+01	9.70E+00	7.34E+00	5.88E+00	4.92E+00	4.53E+00
65	1.03E+01	6.35E+00	4.21E+00	2.95E+00	2.17E+00	1.65E+00	1.44E+00
66	1.06E+02	6.49E+01	4.37E+01	3.18E+01	2.46E+01	2.00E+01	1.81E+01
67	1.26E+02	7.86E+01	5.41E+01	4.02E+01	3.19E+01	2.64E+01	2.43E+01
68	1.14E+02	7.09E+01	4.84E+01	3.58E+01	2.82E+01	2.33E+01	2.14E+01
69	1.18E+02	7.29E+01	4.97E+01	3.68E+01	2.92E+01	2.43E+01	2.23E+01
70	1.24E+02	8.01E+01	5.65E+01	4.30E+01	3.47E+01	2.93E+01	2.71E+01

TABLE A8. (Continued.)

RAD PER HOUR							
DETECTOR NO.	2.45 YR.	3.45 YR.	4.45 YR.	5.45 YR.	6.45 YR.	7.45 YR.	8.00 YR.
71	9.28E+01	5.86E+01	4.17E+01	3.26E+01	2.74E+01	2.40E+01	2.27E+01
72	7.85E+00	4.77E+00	3.31E+00	2.57E+00	2.16E+00	1.91E+00	1.82E+00
73	6.07E+00	3.51E+00	2.19E+00	1.46E+00	1.02E+00	7.38E-01	6.28E-01
74	4.50E+01	2.68E+01	1.77E+01	1.28E+01	1.00E+01	8.23E+00	7.54E+00
75	5.08E+01	3.00E+01	1.97E+01	1.43E+01	1.12E+01	9.24E+00	8.49E+00
76	4.67E+01	2.77E+01	1.84E+01	1.34E+01	1.06E+01	8.88E+00	8.21E+00
77	4.62E+01	2.73E+01	1.80E+01	1.31E+01	1.04E+01	8.69E+00	8.03E+00
78	5.65E+01	3.58E+01	2.48E+01	1.84E+01	1.45E+01	1.19E+01	1.08E+01
79	3.86E+01	2.42E+01	1.73E+01	1.37E+01	1.17E+01	1.04E+01	9.92E+00
80	3.39E+00	1.76E+00	1.05E+00	7.19E-01	5.61E-01	4.77E-01	4.48E-01
81	2.94E+00	1.53E+00	8.66E-01	5.32E-01	3.52E-01	2.46E-01	2.07E-01
82	2.07E+01	1.12E+01	6.66E+00	4.30E+00	2.99E+00	2.21E+00	1.91E+00
83	2.90E+01	1.64E+01	1.02E+01	7.02E+00	5.22E+00	4.12E+00	3.71E+00
84	2.16E+01	1.23E+01	7.80E+00	5.48E+00	4.21E+00	3.44E+00	3.14E+00
85	2.03E+01	1.12E+01	7.01E+00	5.01E+00	3.99E+00	3.41E+00	3.20E+00
86	2.12E+01	1.24E+01	8.07E+00	5.79E+00	4.50E+00	3.71E+00	3.41E+00
87	1.75E+01	1.07E+01	7.33E+00	5.60E+00	4.63E+00	4.02E+00	3.79E+00
88	2.35E+00	1.07E+00	5.27E-01	2.97E-01	1.98E-01	1.53E-01	1.39E-01
89	2.78E+00	1.76E+00	1.16E+00	7.92E-01	5.50E-01	3.86E-01	3.19E-01
90	6.45E+00	3.08E+00	1.63E+00	9.82E-01	6.82E-01	5.32E-01	4.82E-01
91	1.25E+01	6.70E+00	4.03E+00	2.71E+00	2.02E+00	1.62E+00	1.48E+00
92	1.17E+01	6.31E+00	3.81E+00	2.59E+00	1.96E+00	1.60E+00	1.47E+00
93	7.94E+00	3.74E+00	1.95E+00	1.17E+00	8.27E-01	6.62E-01	6.10E-01
94	1.27E+01	7.45E+00	4.77E+00	3.30E+00	2.44E+00	1.89E+00	1.68E+00
95	7.69E+00	4.96E+00	3.69E+00	3.06E+00	2.72E+00	2.51E+00	2.42E+00
96	1.36E+00	6.67E-01	3.76E-01	2.51E-01	1.96E-01	1.70E-01	1.62E-01
97	1.71E-01	1.12E-01	7.61E-02	5.26E-02	3.69E-02	2.60E-02	2.16E-02
98	1.46E+00	6.64E-01	3.33E-01	1.93E-01	1.33E-01	1.06E-01	9.76E-02
99	2.71E+00	1.28E+00	6.64E-01	3.87E-01	2.58E-01	1.92E-01	1.71E-01
100	3.74E+00	1.82E+00	9.69E-01	5.77E-01	3.87E-01	2.88E-01	2.54E-01
101	2.04E+00	8.42E-01	3.49E-01	1.46E-01	6.17E-02	2.67E-02	1.73E-02
102	1.57E+00	9.33E-01	6.21E-01	4.57E-01	3.63E-01	3.05E-01	2.82E-01
103	1.20E+00	5.40E-01	2.57E-01	1.31E-01	7.36E-02	4.50E-02	3.58E-02
104	7.32E-01	5.36E-01	4.50E-01	4.09E-01	3.88E-01	3.74E-01	3.68E-01

TABLE A9. The calculated absorbed dose (rad to GRANITE) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be VOID.

DETECTOR NO.	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	7.60E+08	1.04E+09	2.82E+08
2	9.30E+08	1.28E+09	3.45E+08
3	9.64E+08	1.33E+09	3.62E+08
4	9.95E+08	1.36E+09	3.68E+08
5	9.80E+08	1.35E+09	3.71E+08
6	7.88E+08	1.08E+09	2.93E+08
7	2.75E+08	3.75E+08	9.95E+07
8	3.41E+08	4.67E+08	1.27E+08
9	3.46E+08	4.75E+08	1.29E+08
10	3.44E+08	4.70E+08	1.26E+08
11	3.43E+08	4.70E+08	1.27E+08
12	2.85E+08	3.91E+08	1.06E+08
13	1.55E+08	2.11E+08	5.62E+07
14	1.96E+08	2.69E+08	7.28E+07
15	2.04E+08	2.80E+08	7.58E+07
16	2.00E+08	2.73E+08	7.33E+07
17	2.01E+08	2.74E+08	7.35E+07
18	1.67E+08	2.28E+08	6.13E+07
19	1.15E+08	1.57E+08	4.20E+07
20	1.57E+08	2.16E+08	5.88E+07
21	1.59E+08	2.18E+08	5.85E+07
22	1.57E+08	2.15E+08	5.81E+07
23	1.59E+08	2.16E+08	5.77E+07
24	1.28E+08	1.75E+08	4.71E+07
25	6.32E+06	8.60E+06	2.28E+06
26	7.68E+07	1.05E+08	2.79E+07
27	1.05E+08	1.43E+08	3.86E+07
28	1.13E+08	1.54E+08	4.11E+07
29	1.21E+08	1.66E+08	4.45E+07
30	1.09E+08	1.49E+08	4.01E+07
31	8.83E+07	1.21E+08	3.24E+07
32	7.74E+06	1.06E+07	2.89E+06
33	3.94E+06	5.33E+06	1.38E+06
34	5.20E+07	7.06E+07	1.86E+07
35	6.64E+07	9.04E+07	2.41E+07

TABLE A9. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	7.18E+07	9.81E+07	2.64E+07
37	7.00E+07	9.54E+07	2.54E+07
38	7.03E+07	9.56E+07	2.53E+07
39	5.67E+07	7.73E+07	2.06E+07
40	4.68E+06	6.38E+06	1.70E+06
41	2.67E+06	3.66E+06	9.88E+05
42	3.26E+07	4.41E+07	1.16E+07
43	4.40E+07	5.97E+07	1.57E+07
44	4.70E+07	6.40E+07	1.70E+07
45	4.50E+07	6.09E+07	1.60E+07
46	4.73E+07	6.41E+07	1.68E+07
47	3.75E+07	5.10E+07	1.34E+07
48	3.20E+06	4.37E+06	1.17E+06
49	1.56E+06	2.05E+06	4.94E+05
50	2.20E+07	2.97E+07	7.67E+06
51	2.81E+07	3.82E+07	1.01E+07
52	3.03E+07	4.10E+07	1.07E+07
53	2.93E+07	3.96E+07	1.04E+07
54	3.06E+07	4.13E+07	1.07E+07
55	2.32E+07	3.12E+07	8.01E+06
56	2.16E+06	2.97E+06	8.11E+05
57	6.24E+05	8.28E+05	2.04E+05
58	8.76E+06	1.17E+07	2.91E+06
59	1.26E+07	1.69E+07	4.30E+06
60	1.17E+07	1.55E+07	3.88E+06
61	1.17E+07	1.56E+07	3.90E+06
62	1.28E+07	1.72E+07	4.37E+06
63	9.84E+06	1.32E+07	3.37E+06
64	1.04E+06	1.40E+06	3.56E+05
65	2.69E+05	3.53E+05	8.37E+04
66	3.59E+06	4.73E+06	1.14E+06
67	5.14E+06	6.81E+06	1.67E+06
68	4.70E+06	6.29E+06	1.58E+06
69	4.65E+06	6.14E+06	1.49E+06
70	5.26E+06	7.01E+06	1.75E+06

TABLE A9. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	4.58E+06	6.06E+06	1.48E+06
72	4.28E+05	5.80E+05	1.53E+05
73	8.14E+04	1.02E+05	2.10E+04
74	1.48E+06	1.91E+06	4.37E+05
75	2.31E+06	3.01E+06	7.06E+05
76	2.02E+06	2.66E+06	6.40E+05
77	1.88E+06	2.45E+06	5.70E+05
78	2.12E+06	2.77E+06	6.54E+05
79	2.10E+06	2.76E+06	6.55E+05
80	2.68E+05	3.66E+05	9.78E+04
81	3.83E+04	4.29E+04	4.63E+03
82	6.51E+05	8.49E+05	1.98E+05
83	8.05E+05	1.03E+06	2.28E+05
84	8.09E+05	1.04E+06	2.33E+05
85	8.00E+05	1.01E+06	2.06E+05
86	9.23E+05	1.18E+06	2.53E+05
87	8.04E+05	1.06E+06	2.56E+05
88	1.33E+05	1.86E+05	5.37E+04
89	1.99E+04	2.19E+04	1.99E+03
90	2.29E+05	2.89E+05	6.01E+04
91	3.55E+05	4.50E+05	9.50E+04
92	3.43E+05	4.49E+05	1.06E+05
93	3.03E+05	3.73E+05	7.00E+04
94	4.93E+05	6.40E+05	1.47E+05
95	3.58E+05	4.77E+05	1.19E+05
96	3.75E+04	5.16E+04	1.41E+04
97	5.94E+03	6.31E+03	3.68E+02
98	3.54E+04	4.34E+04	8.08E+03
99	6.91E+04	8.41E+04	1.50E+04
100	5.93E+04	6.82E+04	8.87E+03
101	5.26E+04	6.24E+04	9.82E+03
102	6.52E+04	7.66E+04	1.14E+04
103	7.53E+04	9.69E+04	2.16E+04
104	1.83E+04	2.36E+04	5.33E+03

**TABLE A10.** The calculated absorbed dose (rad to GRANITE) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be filled with WATER.

DETECTOR NO.	RAD(S)		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	7.74E+08	1.06E+09	2.85E+08
2	9.32E+08	1.28E+09	3.50E+08
3	9.61E+08	1.32E+09	3.60E+08
4	9.72E+08	1.34E+09	3.66E+08
5	9.84E+08	1.36E+09	3.73E+08
6	7.88E+08	1.08E+09	2.93E+08
7	2.63E+08	3.59E+08	9.59E+07
8	3.39E+08	4.65E+08	1.26E+08
9	3.46E+08	4.76E+08	1.29E+08
10	3.47E+08	4.76E+08	1.28E+08
11	3.37E+08	4.62E+08	1.25E+08
12	1.43E+08	2.09E+08	6.61E+07
13	1.41E+08	1.97E+08	5.56E+07
14	2.07E+08	2.85E+08	7.80E+07
15	2.18E+08	2.98E+08	8.08E+07
16	2.11E+08	2.90E+08	7.91E+07
17	2.05E+08	2.80E+08	7.46E+07
18	1.70E+08	2.33E+08	6.29E+07
19	3.74E+07	5.40E+07	1.66E+07
20	1.03E+08	1.40E+08	3.77E+07
21	1.12E+08	1.53E+08	4.07E+07
22	1.07E+08	1.46E+08	3.89E+07
23	1.08E+08	1.48E+08	3.96E+07
24	8.89E+07	1.21E+08	3.25E+07
25	3.26E+06	4.34E+06	1.08E+06
26	4.93E+07	6.75E+07	1.82E+07
27	6.30E+07	8.58E+07	2.28E+07
28	6.93E+07	9.46E+07	2.53E+07
29	6.76E+07	9.21E+07	2.44E+07
30	6.93E+07	9.39E+07	2.46E+07
31	5.67E+07	7.76E+07	2.09E+07
32	4.00E+06	5.49E+06	1.49E+06
33	2.35E+06	3.15E+06	8.00E+05
34	1.75E+07	2.48E+07	7.33E+06
35	4.48E+07	6.16E+07	1.68E+07

TABLE A10. (Continued.)

DETECTOR NO.	RADs		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	4.33E+07	5.91E+07	1.59E+07
37	4.44E+07	6.05E+07	1.61E+07
38	4.01E+07	5.59E+07	1.58E+07
39	3.91E+07	5.29E+07	1.38E+07
40	2.67E+06	3.63E+06	9.60E+05
41	1.96E+06	2.54E+06	5.73E+05
42	2.06E+07	2.76E+07	7.04E+06
43	2.81E+07	3.76E+07	9.59E+06
44	2.69E+07	3.68E+07	9.86E+06
45	2.90E+07	3.94E+07	1.04E+07
46	2.78E+07	3.76E+07	9.84E+06
47	2.50E+07	3.38E+07	8.83E+06
48	1.60E+06	2.19E+06	5.92E+05
49	6.46E+05	8.44E+05	1.97E+05
50	1.29E+07	1.74E+07	4.52E+06
51	1.62E+07	2.18E+07	5.63E+06
52	1.74E+07	2.34E+07	6.02E+06
53	1.81E+07	2.44E+07	6.25E+06
54	1.82E+07	2.43E+07	6.15E+06
55	1.57E+07	2.11E+07	5.32E+06
56	5.46E+06	8.61E+06	3.15E+06
57	3.35E+05	4.60E+05	1.25E+05
58	4.95E+06	6.63E+06	1.68E+06
59	7.51E+06	1.000E+07	2.53E+06
60	7.54E+06	1.02E+07	2.68E+06
61	7.64E+06	1.01E+07	2.51E+06
62	7.67E+06	1.02E+07	2.51E+06
63	6.67E+06	9.00E+06	2.33E+06
64	1.87E+06	2.12E+06	2.48E+05
65	2.63E+05	3.76E+05	1.13E+05
66	2.45E+06	3.29E+06	8.43E+05
67	2.88E+06	3.79E+06	9.10E+05
68	2.76E+06	3.65E+06	8.94E+05
69	2.79E+06	3.66E+06	8.73E+05
70	1.60E+06	2.14E+06	5.47E+05

TABLE A10. (Continued.)

DETECTOR NO.	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	3.38E+06	4.48E+06	1.10E+06
72	2.21E+05	2.94E+05	7.28E+04
73	4.11E+04	5.11E+04	9.97E+03
74	9.46E+05	1.23E+06	2.85E+05
75	9.30E+05	1.18E+06	2.50E+05
76	1.19E+06	1.54E+06	3.53E+05
77	1.05E+06	1.37E+06	3.16E+05
78	1.39E+06	1.80E+06	4.02E+05
79	1.31E+06	1.74E+06	4.25E+05
80	8.28E+04	1.10E+05	2.67E+04
81	3.22E+04	3.85E+04	6.29E+03
82	3.32E+05	4.24E+05	9.26E+04
83	4.28E+05	5.31E+05	1.04E+05
84	5.50E+05	7.12E+05	1.63E+05
85	4.30E+05	5.42E+05	1.12E+05
86	4.67E+05	5.86E+05	1.18E+05
87	4.78E+05	6.20E+05	1.42E+05
88	6.44E+04	9.10E+04	2.66E+04
89	4.98E+03	5.29E+03	3.10E+02
90	1.38E+05	1.67E+05	2.86E+04
91	1.92E+05	2.31E+05	3.85E+04
92	2.79E+05	3.46E+05	6.73E+04
93	1.70E+05	2.11E+05	4.09E+04
94	2.42E+05	2.94E+05	5.17E+04
95	2.47E+05	3.21E+05	7.40E+04
96	6.24E+04	9.02E+04	2.78E+04
97	6.38E+02	8.95E+02	2.56E+02
98	3.25E+04	3.84E+04	5.86E+03
99	4.03E+04	4.46E+04	4.28E+03
100	5.34E+04	6.09E+04	7.53E+03
101	2.77E+04	3.33E+04	5.61E+03
102	2.76E+04	3.16E+04	3.96E+03
103	4.40E+04	5.35E+04	9.48E+03
104	1.47E+04	2.13E+04	6.63E+03

TABLE A11. The calculated absorbed dose (rad to GRANITE) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be filled with COMPACTED BENTONITE.

DETECTOR NO.	RAD(S)		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	7.70E+08	1.06E+09	2.86E+08
2	9.33E+08	1.28E+09	3.50E+08
3	9.54E+08	1.31E+09	3.58E+08
4	1.00E+09	1.38E+09	3.76E+08
5	9.87E+08	1.36E+09	3.70E+08
6	7.85E+08	1.08E+09	2.93E+08
7	2.67E+08	3.65E+08	9.76E+07
8	3.42E+08	4.69E+08	1.27E+08
9	3.47E+08	4.77E+08	1.29E+08
10	3.55E+08	4.85E+08	1.30E+08
11	3.44E+08	4.70E+08	1.26E+08
12	2.87E+08	3.94E+08	1.07E+08
13	1.61E+08	2.19E+08	5.80E+07
14	2.08E+08	2.85E+08	7.72E+07
15	2.19E+08	3.00E+08	8.12E+07
16	2.17E+08	2.97E+08	7.98E+07
17	2.12E+08	2.90E+08	7.76E+07
18	1.74E+08	2.38E+08	6.35E+07
19	5.21E+07	7.10E+07	1.90E+07
20	6.94E+07	9.53E+07	2.59E+07
21	7.09E+07	9.63E+07	2.54E+07
22	7.07E+07	9.62E+07	2.55E+07
23	7.05E+07	9.61E+07	2.56E+07
24	5.67E+07	7.71E+07	2.04E+07
25	1.94E+06	2.79E+06	8.46E+05
26	3.39E+07	4.57E+07	1.18E+07
27	4.33E+07	5.86E+07	1.53E+07
28	4.51E+07	6.14E+07	1.63E+07
29	4.53E+07	6.16E+07	1.63E+07
30	4.52E+07	6.14E+07	1.62E+07
31	3.73E+07	5.05E+07	1.32E+07
32	1.95E+06	2.66E+06	7.13E+05
33	1.02E+06	1.32E+06	2.97E+05
34	2.08E+07	2.79E+07	7.10E+06
35	2.54E+07	3.44E+07	8.98E+06

TABLE A11. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	2.70E+07	3.64E+07	9.43E+06
37	2.91E+07	3.93E+07	1.02E+07
38	2.91E+07	3.96E+07	1.05E+07
39	2.38E+07	3.22E+07	8.40E+06
40	1.24E+06	1.70E+06	4.55E+05
41	5.50E+05	7.30E+05	1.80E+05
42	1.27E+07	1.69E+07	4.19E+06
43	1.63E+07	2.20E+07	5.68E+06
44	1.67E+07	2.24E+07	5.75E+06
45	1.91E+07	2.58E+07	6.71E+06
46	1.86E+07	2.50E+07	6.35E+06
47	1.57E+07	2.11E+07	5.37E+06
48	9.07E+05	1.21E+06	3.07E+05
49	5.09E+05	6.62E+05	1.52E+05
50	8.04E+06	1.08E+07	2.74E+06
51	1.10E+07	1.47E+07	3.68E+06
52	1.09E+07	1.47E+07	3.79E+06
53	1.20E+07	1.60E+07	4.04E+06
54	1.21E+07	1.62E+07	4.09E+06
55	9.90E+06	1.33E+07	3.35E+06
56	5.33E+05	7.27E+05	1.95E+05
57	4.13E+05	5.46E+05	1.34E+05
58	3.68E+06	4.90E+06	1.22E+06
59	4.47E+06	5.90E+06	1.43E+06
60	4.30E+06	5.74E+06	1.43E+06
61	4.28E+06	5.64E+06	1.36E+06
62	4.66E+06	6.21E+06	1.55E+06
63	5.18E+06	7.10E+06	1.91E+06
64	2.72E+05	3.67E+05	9.51E+04
65	8.21E+04	1.11E+05	2.90E+04
66	1.34E+06	1.73E+06	3.82E+05
67	1.73E+06	2.24E+06	5.03E+05
68	1.74E+06	2.25E+06	5.16E+05
69	1.75E+06	2.30E+06	5.47E+05
70	2.04E+06	2.71E+06	6.64E+05

TABLE A11. (Continued.)

DETECTOR NO.	RADs		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	1.79E+06	2.37E+06	5.79E+05
72	1.59E+05	2.09E+05	5.05E+04
73	3.69E+04	4.61E+04	9.16E+03
74	5.84E+05	7.46E+05	1.62E+05
75	6.91E+05	8.63E+05	1.72E+05
76	7.48E+05	9.62E+05	2.14E+05
77	7.48E+05	9.62E+05	2.14E+05
78	1.03E+06	1.34E+06	3.09E+05
79	6.43E+05	8.47E+05	2.03E+05
80	5.99E+04	7.58E+04	1.59E+04
81	9.67E+03	1.05E+04	8.43E+02
82	2.12E+05	2.58E+05	4.61E+04
83	3.17E+05	3.93E+05	7.64E+04
84	3.01E+05	3.78E+05	7.68E+04
85	3.11E+05	4.00E+05	8.85E+04
86	3.95E+05	5.02E+05	1.06E+05
87	3.11E+05	4.03E+05	9.20E+04
88	3.72E+04	4.47E+04	7.49E+03
89	2.66E+03	2.82E+03	1.65E+02
90	9.60E+04	1.15E+05	1.88E+04
91	1.38E+05	1.64E+05	2.60E+04
92	1.49E+05	1.88E+05	3.95E+04
93	1.31E+05	1.63E+05	3.17E+04
94	3.06E+05	3.82E+05	7.62E+04
95	1.74E+05	2.27E+05	5.29E+04
96	2.16E+04	2.66E+04	5.01E+03
97	5.09E-01	6.33E-01	1.24E-01
98	1.18E+04	1.47E+04	2.95E+03
99	2.27E+04	2.44E+04	1.71E+03
100	3.31E+04	3.88E+04	5.66E+03
101	2.76E+04	3.18E+04	4.20E+03
102	2.02E+04	2.36E+04	3.33E+03
103	3.50E+04	4.18E+04	6.75E+03
104	1.47E+04	2.21E+04	7.40E+03

TABLE A12. The calculated absorbed dose (rad to GRANITE) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	8.02E+08	1.10E+09	2.93E+08
2	9.22E+08	1.27E+09	3.46E+08
3	9.65E+08	1.33E+09	3.61E+08
4	9.79E+08	1.35E+09	3.71E+08
5	9.82E+08	1.35E+09	3.70E+08
6	8.10E+08	1.11E+09	2.99E+08
7	2.69E+08	3.68E+08	9.85E+07
8	3.43E+08	4.70E+08	1.28E+08
9	3.51E+08	4.82E+08	1.31E+08
10	3.39E+08	4.64E+08	1.25E+08
11	3.45E+08	4.73E+08	1.28E+08
12	2.92E+08	4.00E+08	1.07E+08
13	1.64E+08	2.24E+08	5.95E+07
14	2.15E+08	2.94E+08	7.94E+07
15	2.17E+08	2.98E+08	8.08E+07
16	2.08E+08	2.85E+08	7.67E+07
17	2.14E+08	2.93E+08	7.85E+07
18	1.71E+08	2.35E+08	6.31E+07
19	5.16E+07	7.00E+07	1.84E+07
20	6.69E+07	9.16E+07	2.46E+07
21	6.74E+07	9.20E+07	2.46E+07
22	6.66E+07	9.13E+07	2.47E+07
23	6.95E+07	9.44E+07	2.50E+07
24	5.87E+07	7.97E+07	2.09E+07
25	1.93E+06	2.54E+06	6.14E+05
26	3.23E+07	4.35E+07	1.12E+07
27	4.21E+07	5.73E+07	1.52E+07
28	4.49E+07	6.09E+07	1.60E+07
29	4.20E+07	5.72E+07	1.52E+07
30	4.28E+07	5.83E+07	1.55E+07
31	3.62E+07	4.91E+07	1.29E+07
32	2.37E+06	3.26E+06	8.87E+05
33	1.37E+06	1.82E+06	4.45E+05
34	2.07E+07	2.77E+07	6.99E+06
35	2.59E+07	3.52E+07	9.26E+06

TABLE A12. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	2.74E+07	3.70E+07	9.68E+06
37	2.67E+07	3.63E+07	9.56E+06
38	2.71E+07	3.66E+07	9.54E+06
39	2.18E+07	2.95E+07	7.78E+06
40	1.83E+06	2.45E+06	6.25E+05
41	9.21E+05	1.21E+06	2.86E+05
42	1.28E+07	1.70E+07	4.26E+06
43	1.64E+07	2.21E+07	5.70E+06
44	1.71E+07	2.31E+07	6.00E+06
45	1.64E+07	2.21E+07	5.71E+06
46	1.73E+07	2.33E+07	6.03E+06
47	1.35E+07	1.83E+07	4.76E+06
48	1.53E+06	2.05E+06	5.19E+05
49	6.52E+05	8.56E+05	2.04E+05
50	8.36E+06	1.12E+07	2.79E+06
51	1.05E+07	1.39E+07	3.47E+06
52	1.10E+07	1.48E+07	3.78E+06
53	1.03E+07	1.38E+07	3.50E+06
54	1.08E+07	1.44E+07	3.66E+06
55	9.00E+06	1.22E+07	3.17E+06
56	9.84E+05	1.36E+06	3.73E+05
57	2.81E+05	3.66E+05	8.50E+04
58	3.39E+06	4.48E+06	1.09E+06
59	5.27E+06	7.02E+06	1.75E+06
60	4.43E+06	5.84E+06	1.41E+06
61	4.16E+06	5.46E+06	1.30E+06
62	4.21E+06	5.59E+06	1.38E+06
63	3.97E+06	5.43E+06	1.47E+06
64	3.54E+05	4.67E+05	1.13E+05
65	1.61E+05	2.03E+05	4.19E+04
66	1.66E+06	2.13E+06	4.76E+05
67	2.02E+06	2.63E+06	6.16E+05
68	1.82E+06	2.36E+06	5.46E+05
69	1.87E+06	2.44E+06	5.64E+05
70	2.07E+06	2.74E+06	6.71E+05

TABLE A12. (Continued.)

DETECTOR NO.	RADs		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	1.52E+06	2.05E+06	5.28E+05
72	1.25E+05	1.67E+05	4.20E+04
73	8.81E+04	1.08E+05	1.98E+04
74	6.83E+05	8.77E+05	1.94E+05
75	7.63E+05	9.79E+05	2.16E+05
76	7.09E+05	9.14E+05	2.06E+05
77	6.99E+05	9.01E+05	2.02E+05
78	9.19E+05	1.20E+06	2.80E+05
79	6.31E+05	8.57E+05	2.25E+05
80	4.49E+04	5.59E+04	1.10E+04
81	3.78E+04	4.46E+04	6.84E+03
82	2.80E+05	3.38E+05	5.82E+04
83	4.13E+05	5.14E+05	1.01E+05
84	3.12E+05	3.93E+05	8.15E+04
85	2.86E+05	3.64E+05	7.80E+04
86	3.15E+05	4.02E+05	8.72E+04
87	2.75E+05	3.64E+05	8.92E+04
88	2.65E+04	3.04E+04	3.95E+03
89	4.43E+04	5.49E+04	1.06E+04
90	7.67E+04	9.02E+04	1.35E+04
91	1.69E+05	2.08E+05	3.93E+04
92	1.59E+05	1.97E+05	3.81E+04
93	9.32E+04	1.10E+05	1.64E+04
94	1.87E+05	2.34E+05	4.70E+04
95	1.32E+05	1.84E+05	5.27E+04
96	1.69E+04	2.08E+04	3.88E+03
97	2.81E+03	3.52E+03	7.09E+02
98	1.66E+04	1.92E+04	2.64E+03
99	3.17E+04	3.68E+04	5.08E+03
100	4.51E+04	5.28E+04	7.67E+03
101	2.03E+04	2.17E+04	1.32E+03
102	2.40E+04	3.11E+04	7.07E+03
103	1.32E+04	1.47E+04	1.48E+03
104	1.46E+04	2.19E+04	7.39E+03

TABLE A13. The calculated absorbed dose (rad to LiF) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be VOID.

DETECTOR NO.	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	7.04E+08	9.65E+08	2.61E+08
2	8.62E+08	1.18E+09	3.20E+08
3	8.94E+08	1.23E+09	3.36E+08
4	9.22E+08	1.26E+09	3.41E+08
5	9.08E+08	1.25E+09	3.44E+08
6	7.30E+08	1.00E+09	2.72E+08
7	2.54E+08	3.46E+08	9.19E+07
8	3.15E+08	4.32E+08	1.17E+08
9	3.19E+08	4.38E+08	1.19E+08
10	3.18E+08	4.34E+08	1.16E+08
11	3.17E+08	4.34E+08	1.17E+08
12	2.64E+08	3.61E+08	9.75E+07
13	1.43E+08	1.95E+08	5.19E+07
14	1.81E+08	2.48E+08	6.71E+07
15	1.88E+08	2.58E+08	6.99E+07
16	1.84E+08	2.52E+08	6.75E+07
17	1.85E+08	2.53E+08	6.77E+07
18	1.54E+08	2.11E+08	5.65E+07
19	1.06E+08	1.45E+08	3.86E+07
20	1.45E+08	1.99E+08	5.41E+07
21	1.47E+08	2.00E+08	5.38E+07
22	1.44E+08	1.98E+08	5.34E+07
23	1.46E+08	1.99E+08	5.30E+07
24	1.18E+08	1.61E+08	4.33E+07
25	5.81E+06	7.90E+06	2.09E+06
26	7.05E+07	9.62E+07	2.56E+07
27	9.61E+07	1.32E+08	3.54E+07
28	1.03E+08	1.41E+08	3.77E+07
29	1.11E+08	1.52E+08	4.08E+07
30	9.99E+07	1.37E+08	3.68E+07
31	8.11E+07	1.11E+08	2.98E+07
32	7.10E+06	9.75E+06	2.65E+06
33	3.62E+06	4.89E+06	1.27E+06
34	4.77E+07	6.47E+07	1.71E+07
35	6.09E+07	8.30E+07	2.21E+07

TABLE A13. (Continued.)

DETECTOR NO.	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	6.58E+07	9.00E+07	2.42E+07
37	6.42E+07	8.75E+07	2.33E+07
38	6.45E+07	8.77E+07	2.32E+07
39	5.20E+07	7.09E+07	1.89E+07
40	4.29E+06	5.84E+06	1.55E+06
41	2.45E+06	3.35E+06	9.04E+05
42	2.99E+07	4.05E+07	1.06E+07
43	4.03E+07	5.47E+07	1.44E+07
44	4.31E+07	5.87E+07	1.56E+07
45	4.12E+07	5.58E+07	1.46E+07
46	4.34E+07	5.88E+07	1.54E+07
47	3.44E+07	4.67E+07	1.23E+07
48	2.94E+06	4.01E+06	1.07E+06
49	1.43E+06	1.88E+06	4.53E+05
50	2.02E+07	2.72E+07	7.02E+06
51	2.57E+07	3.50E+07	9.22E+06
52	2.78E+07	3.76E+07	9.81E+06
53	2.68E+07	3.63E+07	9.49E+06
54	2.80E+07	3.79E+07	9.83E+06
55	2.13E+07	2.86E+07	7.34E+06
56	1.97E+06	2.72E+06	7.42E+05
57	5.71E+05	7.58E+05	1.87E+05
58	8.02E+06	1.07E+07	2.67E+06
59	1.15E+07	1.55E+07	3.93E+06
60	1.07E+07	1.43E+07	3.57E+06
61	1.07E+07	1.43E+07	3.57E+06
62	1.17E+07	1.57E+07	4.00E+06
63	9.02E+06	1.21E+07	3.08E+06
64	9.57E+05	1.29E+06	3.29E+05
65	2.47E+05	3.24E+05	7.69E+04
66	3.29E+06	4.33E+06	1.04E+06
67	4.71E+06	6.24E+06	1.53E+06
68	4.32E+06	5.78E+06	1.46E+06
69	4.27E+06	5.64E+06	1.37E+06
70	4.82E+06	6.42E+06	1.60E+06

TABLE A13. (Continued.)

DETECTOR NO.	RADs		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	4.19E+06	5.55E+06	1.36E+06
72	4.15E+05	5.69E+05	1.54E+05
73	8.80E+04	1.15E+05	2.73E+04
74	1.36E+06	1.76E+06	4.03E+05
75	2.12E+06	2.76E+06	6.47E+05
76	1.86E+06	2.45E+06	5.91E+05
77	1.72E+06	2.24E+06	5.21E+05
78	2.07E+06	2.74E+06	6.74E+05
79	1.93E+06	2.53E+06	6.00E+05
80	2.58E+05	3.55E+05	9.68E+04
81	3.79E+04	4.38E+04	5.87E+03
82	5.95E+05	7.75E+05	1.80E+05
83	7.40E+05	9.49E+05	2.09E+05
84	7.83E+05	1.02E+06	2.38E+05
85	7.32E+05	9.20E+05	1.88E+05
86	8.54E+05	1.09E+06	2.36E+05
87	7.46E+05	9.85E+05	2.40E+05
88	1.29E+05	1.83E+05	5.37E+04
89	5.36E+04	7.66E+04	2.31E+04
90	2.09E+05	2.64E+05	5.48E+04
91	3.26E+05	4.14E+05	8.72E+04
92	3.21E+05	4.23E+05	1.01E+05
93	2.78E+05	3.42E+05	6.41E+04
94	4.58E+05	5.96E+05	1.38E+05
95	3.66E+05	4.98E+05	1.32E+05
96	4.12E+04	5.82E+04	1.70E+04
97	5.53E+03	5.90E+03	3.68E+02
98	3.26E+04	4.01E+04	7.51E+03
99	6.49E+04	7.95E+04	1.46E+04
100	5.49E+04	6.33E+04	8.38E+03
101	4.85E+04	5.77E+04	9.19E+03
102	6.49E+04	7.84E+04	1.35E+04
103	7.19E+04	9.35E+04	2.15E+04
104	1.67E+04	2.15E+04	4.87E+03

TABLE A14. The calculated absorbed dose (rad to LiF) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be filled with WATER.

DETECTOR NO.	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	7.18E+08	9.82E+08	2.64E+08
2	8.64E+08	1.19E+09	3.24E+08
3	8.91E+08	1.22E+09	3.34E+08
4	9.01E+08	1.24E+09	3.39E+08
5	9.13E+08	1.26E+09	3.46E+08
6	7.31E+08	1.00E+09	2.72E+08
7	2.43E+08	3.32E+08	8.85E+07
8	3.13E+08	4.29E+08	1.16E+08
9	3.20E+08	4.39E+08	1.19E+08
10	3.21E+08	4.39E+08	1.19E+08
11	3.11E+08	4.26E+08	1.15E+08
12	1.32E+08	1.93E+08	6.10E+07
13	1.43E+08	1.96E+08	5.21E+07
14	1.90E+08	2.62E+08	7.18E+07
15	2.00E+08	2.75E+08	7.44E+07
16	1.94E+08	2.67E+08	7.28E+07
17	1.89E+08	2.58E+08	6.88E+07
18	1.57E+08	2.15E+08	5.80E+07
19	7.18E+07	9.74E+07	2.56E+07
20	9.43E+07	1.29E+08	3.46E+07
21	1.03E+08	1.40E+08	3.73E+07
22	9.82E+07	1.34E+08	3.57E+07
23	9.95E+07	1.36E+08	3.63E+07
24	8.17E+07	1.11E+08	2.98E+07
25	2.99E+06	3.98E+06	9.91E+05
26	4.52E+07	6.19E+07	1.67E+07
27	5.78E+07	7.88E+07	2.09E+07
28	6.36E+07	8.68E+07	2.32E+07
29	4.34E+07	5.42E+07	1.07E+07
30	6.36E+07	8.62E+07	2.25E+07
31	5.20E+07	7.12E+07	1.91E+07
32	3.66E+06	5.03E+06	1.36E+06
33	2.15E+06	2.88E+06	7.33E+05
34	2.98E+07	4.03E+07	1.05E+07
35	4.11E+07	5.64E+07	1.53E+07

TABLE A14. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	3.97E+07	5.42E+07	1.45E+07
37	4.07E+07	5.54E+07	1.47E+07
38	3.68E+07	5.13E+07	1.45E+07
39	3.58E+07	4.84E+07	1.26E+07
40	2.42E+06	3.29E+06	8.72E+05
41	1.79E+06	2.31E+06	5.23E+05
42	1.89E+07	2.53E+07	6.44E+06
43	2.57E+07	3.45E+07	8.77E+06
44	2.47E+07	3.37E+07	9.03E+06
45	2.66E+07	3.61E+07	9.52E+06
46	2.55E+07	3.45E+07	9.01E+06
47	2.29E+07	3.10E+07	8.08E+06
48	1.47E+06	2.01E+06	5.44E+05
49	5.94E+05	7.75E+05	1.82E+05
50	1.18E+07	1.60E+07	4.13E+06
51	1.48E+07	2.00E+07	5.15E+06
52	1.60E+07	2.15E+07	5.51E+06
53	1.66E+07	2.23E+07	5.72E+06
54	1.66E+07	2.23E+07	5.62E+06
55	1.44E+07	1.93E+07	4.88E+06
56	4.99E+06	7.88E+06	2.88E+06
57	3.06E+05	4.19E+05	1.14E+05
58	4.52E+06	6.06E+06	1.54E+06
59	6.88E+06	9.19E+06	2.31E+06
60	6.89E+06	9.34E+06	2.45E+06
61	7.05E+06	9.37E+06	2.32E+06
62	7.02E+06	9.32E+06	2.30E+06
63	6.11E+06	8.24E+06	2.14E+06
64	1.72E+06	1.95E+06	2.28E+05
65	2.38E+05	3.41E+05	1.02E+05
66	2.24E+06	3.00E+06	7.68E+05
67	2.64E+06	3.47E+06	8.30E+05
68	2.53E+06	3.34E+06	8.18E+05
69	2.55E+06	3.35E+06	7.98E+05
70	3.06E+06	4.00E+06	9.43E+05

TABLE A14. (Continued.)

DETECTOR NO.	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	3.08E+06	4.09E+06	1.01E+06
72	2.03E+05	2.70E+05	6.68E+04
73	3.94E+04	4.87E+04	9.30E+03
74	8.64E+05	1.12E+06	2.60E+05
75	8.50E+05	1.08E+06	2.28E+05
76	1.09E+06	1.41E+06	3.23E+05
77	9.59E+05	1.25E+06	2.89E+05
78	1.27E+06	1.64E+06	3.66E+05
79	1.20E+06	1.59E+06	3.89E+05
80	7.57E+04	1.00E+05	2.44E+04
81	2.94E+04	3.51E+04	5.73E+03
82	3.04E+05	3.89E+05	8.46E+04
83	3.92E+05	4.86E+05	9.43E+04
84	5.05E+05	6.54E+05	1.49E+05
85	3.94E+05	4.96E+05	1.03E+05
86	4.29E+05	5.38E+05	1.08E+05
87	4.39E+05	5.68E+05	1.30E+05
88	5.93E+04	8.38E+04	2.45E+04
89	4.64E+03	4.96E+03	3.22E+02
90	1.27E+05	1.53E+05	2.62E+04
91	1.76E+05	2.12E+05	3.51E+04
92	2.55E+05	3.17E+05	6.14E+04
93	1.55E+05	1.93E+05	3.73E+04
94	2.23E+05	2.70E+05	4.73E+04
95	2.27E+05	2.95E+05	6.79E+04
96	5.72E+04	8.27E+04	2.55E+04
97	6.47E+02	9.21E+02	2.74E+02
98	2.98E+04	3.51E+04	5.36E+03
99	3.72E+04	4.11E+04	3.92E+03
100	4.10E+04	4.57E+04	4.71E+03
101	2.69E+04	3.30E+04	6.07E+03
102	2.53E+04	2.90E+04	3.62E+03
103	4.03E+04	4.90E+04	8.67E+03
104	1.36E+04	1.98E+04	6.16E+03

**TABLE A15.** The calculated absorbed dose (rad to LiF) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be filled with COMPACTED BENTONITE.

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	7.14E+08	9.79E+08	2.65E+08
2	8.65E+08	1.19E+09	3.24E+08
3	8.84E+08	1.22E+09	3.32E+08
4	9.27E+08	1.28E+09	3.49E+08
5	9.15E+08	1.26E+09	3.43E+08
6	7.27E+08	9.98E+08	2.71E+08
7	2.46E+08	3.37E+08	9.01E+07
8	3.15E+08	4.33E+08	1.17E+08
9	3.21E+08	4.40E+08	1.19E+08
10	3.27E+08	4.48E+08	1.20E+08
11	3.17E+08	4.34E+08	1.17E+08
12	2.65E+08	3.64E+08	9.84E+07
13	1.48E+08	2.02E+08	5.34E+07
14	1.92E+08	2.63E+08	7.11E+07
15	2.02E+08	2.77E+08	7.48E+07
16	2.00E+08	2.73E+08	7.34E+07
17	1.96E+08	2.67E+08	7.15E+07
18	1.61E+08	2.19E+08	5.85E+07
19	4.78E+07	6.51E+07	1.74E+07
20	6.36E+07	8.73E+07	2.37E+07
21	6.51E+07	8.84E+07	2.33E+07
22	6.48E+07	8.82E+07	2.34E+07
23	6.47E+07	8.81E+07	2.35E+07
24	5.20E+07	7.07E+07	1.87E+07
25	1.77E+06	2.53E+06	7.67E+05
26	3.11E+07	4.19E+07	1.08E+07
27	3.96E+07	5.37E+07	1.40E+07
28	4.14E+07	5.63E+07	1.49E+07
29	4.15E+07	5.65E+07	1.49E+07
30	4.14E+07	5.63E+07	1.49E+07
31	3.42E+07	4.63E+07	1.21E+07
32	1.78E+06	2.44E+06	6.52E+05
33	9.34E+05	1.20E+06	2.71E+05
34	1.90E+07	2.55E+07	6.51E+06
35	2.33E+07	3.15E+07	8.22E+06

TABLE A15. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	2.47E+07	3.33E+07	8.64E+06
37	2.67E+07	3.60E+07	9.38E+06
38	2.67E+07	3.62E+07	9.56E+06
39	2.18E+07	2.96E+07	7.70E+06
40	1.13E+06	1.55E+06	4.16E+05
41	5.04E+05	6.68E+05	1.64E+05
42	1.17E+07	1.55E+07	3.84E+06
43	1.49E+07	2.01E+07	5.20E+06
44	1.53E+07	2.06E+07	5.27E+06
45	1.75E+07	2.37E+07	6.14E+06
46	1.70E+07	2.29E+07	5.81E+06
47	1.44E+07	1.93E+07	4.92E+06
48	8.31E+05	1.11E+06	2.81E+05
49	4.65E+05	6.04E+05	1.40E+05
50	7.37E+06	9.88E+06	2.51E+06
51	1.01E+07	1.35E+07	3.37E+06
52	9.96E+06	1.34E+07	3.47E+06
53	1.09E+07	1.46E+07	3.70E+06
54	1.11E+07	1.49E+07	3.75E+06
55	9.07E+06	1.21E+07	3.07E+06
56	4.88E+05	6.67E+05	1.79E+05
57	3.75E+05	4.97E+05	1.22E+05
58	3.37E+06	4.48E+06	1.11E+06
59	4.09E+06	5.40E+06	1.31E+06
60	3.95E+06	5.27E+06	1.32E+06
61	3.92E+06	5.16E+06	1.24E+06
62	4.27E+06	5.69E+06	1.42E+06
63	4.75E+06	6.50E+06	1.75E+06
64	2.50E+05	3.37E+05	8.73E+04
65	7.49E+04	1.01E+05	2.64E+04
66	1.23E+06	1.58E+06	3.49E+05
67	1.59E+06	2.05E+06	4.63E+05
68	1.60E+06	2.08E+06	4.81E+05
69	1.64E+06	2.16E+06	5.19E+05
70	1.88E+06	2.49E+06	6.11E+05

TABLE A15. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	1.63E+06	2.16E+06	5.29E+05
72	1.45E+05	1.91E+05	4.61E+04
73	3.37E+04	4.20E+04	8.33E+03
74	5.35E+05	6.83E+05	1.48E+05
75	6.32E+05	7.89E+05	1.57E+05
76	6.88E+05	8.85E+05	1.98E+05
77	6.92E+05	8.92E+05	2.00E+05
78	1.05E+06	1.39E+06	3.43E+05
79	5.90E+05	7.76E+05	1.86E+05
80	5.50E+04	6.96E+04	1.46E+04
81	8.91E+03	9.70E+03	7.83E+02
82	1.95E+05	2.37E+05	4.23E+04
83	2.90E+05	3.60E+05	7.00E+04
84	2.78E+05	3.49E+05	7.13E+04
85	2.94E+05	3.79E+05	8.59E+04
86	3.64E+05	4.62E+05	9.79E+04
87	2.86E+05	3.70E+05	8.44E+04
88	3.42E+04	4.11E+04	6.87E+03
89	2.48E+03	2.66E+03	1.81E+02
90	8.83E+04	1.06E+05	1.73E+04
91	1.27E+05	1.50E+05	2.37E+04
92	1.39E+05	1.77E+05	3.78E+04
93	1.25E+05	1.58E+05	3.21E+04
94	2.80E+05	3.49E+05	6.96E+04
95	1.60E+05	2.08E+05	4.84E+04
96	1.97E+04	2.42E+04	4.55E+03
97	5.55E+01	8.87E+01	3.32E+01
98	1.09E+04	1.37E+04	2.78E+03
99	2.10E+04	2.27E+04	1.67E+03
100	3.28E+04	3.94E+04	6.59E+03
101	2.57E+04	2.98E+04	4.10E+03
102	2.05E+04	2.47E+04	4.20E+03
103	3.21E+04	3.82E+04	6.15E+03
104	1.35E+04	2.04E+04	6.83E+03

TABLE A16. The calculated absorbed dose (rad to LiF) at several calculational boundaries (cf. Fig. 4) and over three time periods after discharge of fuel from reactor. The liner/granite gap was assumed to be filled with SAND/BENTONITE.

DETECTOR NO.	RAD'S		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
1	7.43E+08	1.01E+09	2.72E+08
2	8.55E+08	1.18E+09	3.20E+08
3	8.94E+08	1.23E+09	3.34E+08
4	9.07E+08	1.25E+09	3.44E+08
5	9.11E+08	1.25E+09	3.43E+08
6	7.51E+08	1.03E+09	2.77E+08
7	2.48E+08	3.39E+08	9.10E+07
8	3.17E+08	4.34E+08	1.18E+08
9	3.24E+08	4.45E+08	1.21E+08
10	3.13E+08	4.28E+08	1.15E+08
11	3.19E+08	4.37E+08	1.18E+08
12	2.70E+08	3.69E+08	9.91E+07
13	1.51E+08	2.06E+08	5.48E+07
14	1.98E+08	2.71E+08	7.31E+07
15	2.00E+08	2.74E+08	7.44E+07
16	1.91E+08	2.62E+08	7.06E+07
17	1.97E+08	2.69E+08	7.22E+07
18	1.58E+08	2.16E+08	5.81E+07
19	4.74E+07	6.42E+07	1.69E+07
20	6.14E+07	8.40E+07	2.26E+07
21	6.18E+07	8.44E+07	2.25E+07
22	6.11E+07	8.37E+07	2.26E+07
23	6.37E+07	8.65E+07	2.29E+07
24	5.38E+07	7.30E+07	1.92E+07
25	1.77E+06	2.33E+06	5.63E+05
26	2.96E+07	3.98E+07	1.02E+07
27	3.85E+07	5.24E+07	1.39E+07
28	4.11E+07	5.58E+07	1.47E+07
29	3.85E+07	5.24E+07	1.39E+07
30	3.92E+07	5.34E+07	1.42E+07
31	3.31E+07	4.49E+07	1.18E+07
32	2.17E+06	2.99E+06	8.12E+05
33	1.25E+06	1.66E+06	4.06E+05
34	1.90E+07	2.54E+07	6.39E+06
35	2.38E+07	3.22E+07	8.47E+06

TABLE A16. (Continued.)

DETECTOR NO.	RADS		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
36	2.51E+07	3.39E+07	8.87E+06
37	2.45E+07	3.32E+07	8.75E+06
38	2.48E+07	3.35E+07	8.73E+06
39	1.99E+07	2.71E+07	7.13E+06
40	1.68E+06	2.25E+06	5.73E+05
41	8.46E+05	1.11E+06	2.62E+05
42	1.17E+07	1.56E+07	3.90E+06
43	1.50E+07	2.02E+07	5.21E+06
44	1.56E+07	2.11E+07	5.49E+06
45	1.50E+07	2.02E+07	5.22E+06
46	1.58E+07	2.13E+07	5.52E+06
47	1.24E+07	1.67E+07	4.36E+06
48	1.40E+06	1.88E+06	4.75E+05
49	5.98E+05	7.84E+05	1.87E+05
50	7.66E+06	1.02E+07	2.55E+06
51	9.59E+06	1.28E+07	3.18E+06
52	1.01E+07	1.35E+07	3.45E+06
53	9.45E+06	1.26E+07	3.20E+06
54	9.88E+06	1.32E+07	3.35E+06
55	8.24E+06	1.11E+07	2.90E+06
56	8.99E+05	1.24E+06	3.40E+05
57	2.58E+05	3.36E+05	7.78E+04
58	3.11E+06	4.10E+06	9.98E+05
59	4.82E+06	6.42E+06	1.60E+06
60	4.05E+06	5.34E+06	1.29E+06
61	3.81E+06	4.99E+06	1.19E+06
62	3.86E+06	5.11E+06	1.26E+06
63	3.63E+06	4.97E+06	1.34E+06
64	3.24E+05	4.28E+05	1.04E+05
65	1.47E+05	1.85E+05	3.83E+04
66	1.51E+06	1.95E+06	4.34E+05
67	1.84E+06	2.41E+06	5.62E+05
68	1.66E+06	2.16E+06	4.98E+05
69	1.71E+06	2.23E+06	5.15E+05
70	1.89E+06	2.50E+06	6.12E+05

TABLE A16. (Continued.)

DETECTOR NO.	RADs		
	2.45-5.45 YR	2.45-7.45 YR	5.45-7.45 YR
71	1.40E+06	1.88E+06	4.83E+05
72	1.13E+05	1.52E+05	3.82E+04
73	8.05E+04	9.85E+04	1.80E+04
74	6.25E+05	8.02E+05	1.77E+05
75	7.00E+05	8.97E+05	1.97E+05
76	6.49E+05	8.37E+05	1.88E+05
77	6.38E+05	8.22E+05	1.84E+05
78	8.39E+05	1.09E+06	2.55E+05
79	5.79E+05	7.85E+05	2.06E+05
80	4.10E+04	5.10E+04	1.00E+04
81	3.48E+04	4.11E+04	6.29E+03
82	2.57E+05	3.10E+05	5.33E+04
83	3.79E+05	4.71E+05	9.26E+04
84	2.86E+05	3.60E+05	7.46E+04
85	2.61E+05	3.32E+05	7.08E+04
86	2.89E+05	3.69E+05	7.97E+04
87	2.52E+05	3.34E+05	8.18E+04
88	2.43E+04	2.79E+04	3.62E+03
89	4.03E+04	4.99E+04	9.68E+03
90	7.05E+04	8.28E+04	1.23E+04
91	1.55E+05	1.91E+05	3.60E+04
92	1.46E+05	1.81E+05	3.49E+04
93	8.55E+04	1.01E+05	1.50E+04
94	1.72E+05	2.15E+05	4.31E+04
95	1.20E+05	1.68E+05	4.79E+04
96	1.55E+04	1.90E+04	3.52E+03
97	2.58E+03	3.23E+03	6.48E+02
98	1.52E+04	1.76E+04	2.42E+03
99	2.92E+04	3.38E+04	4.67E+03
100	4.15E+04	4.85E+04	7.00E+03
101	1.88E+04	2.00E+04	1.22E+03
102	2.19E+04	2.83E+04	6.42E+03
103	1.22E+04	1.35E+04	1.36E+03
104	1.35E+04	2.03E+04	6.82E+03

